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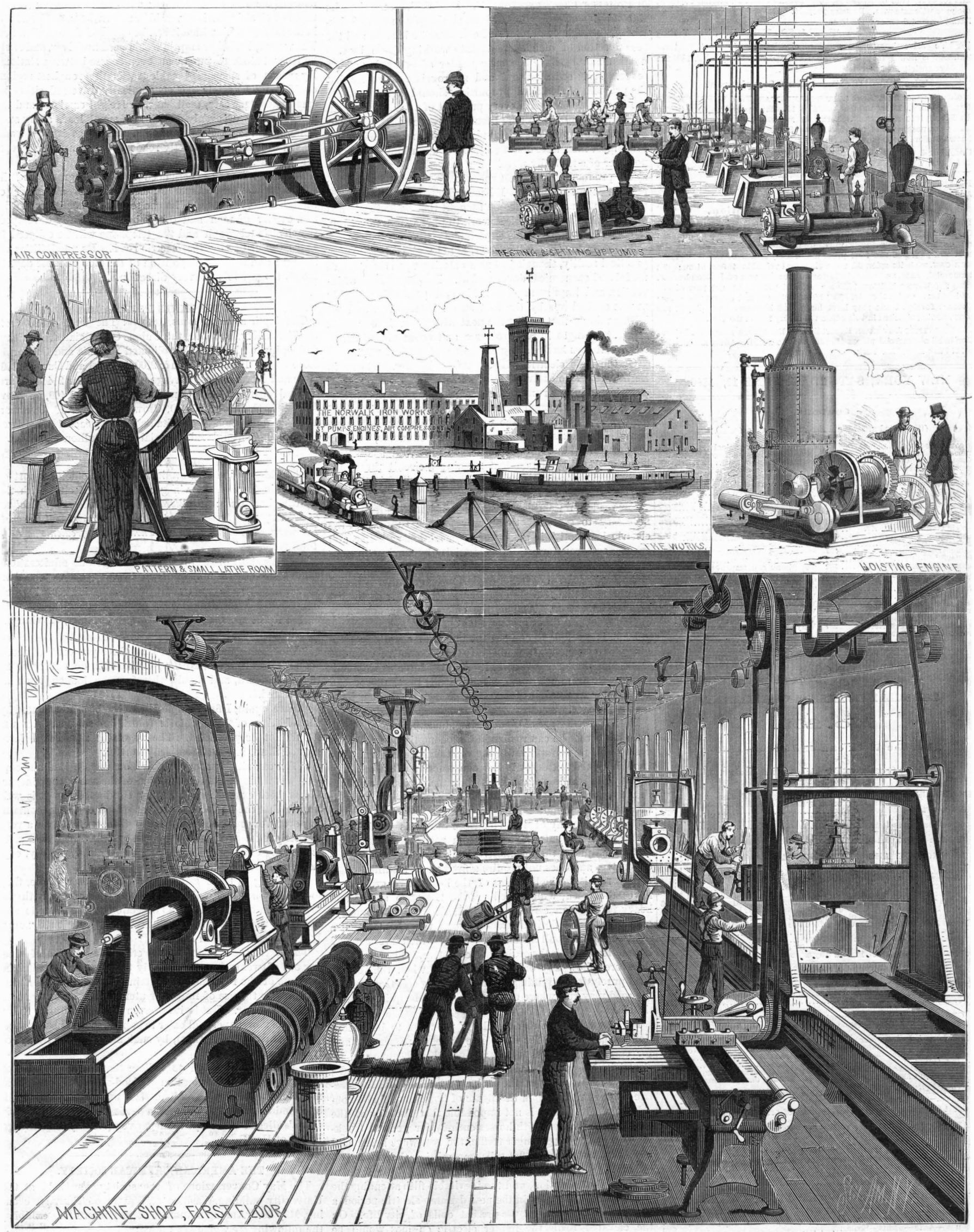

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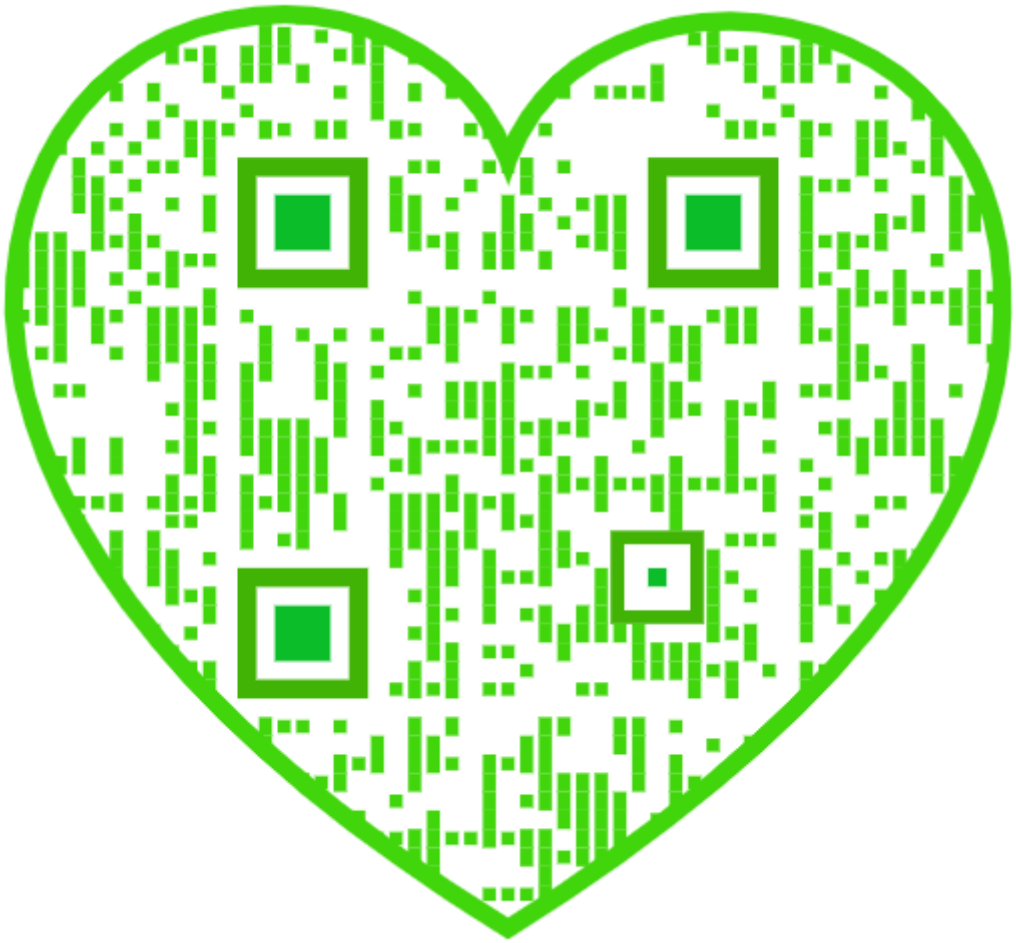

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NEW YORK, SATURDAY, JUNE 12, 1880.

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THE FUTURE OF THE ELECTRIC RAILWAY.

It is now nearly forty years since Professor Page's discoveries in electricity suggested to him the possibility of an electric railway; but in those days the costly galvanic battery was the only source of electricity available for such purposes, and his experimental electric locomotive was a practical failure. His power cost too much, and his machine labored under the disadvantage of having to carry a considerable load of battery cells, the action of which was materially interfered with by the jarring and oscillation of the train when its speed approached three or four miles an hour.

The development of dynamo-electric machines during recent years has so lessened the cost of electricity as a motive power as to remove the most serious obstacle to the success of Professor Page's experiments. During the same time the transmission of powerful currents of cheaply generated electricity, through conductors of considerable length, and the re-conversion of such currents into working force by economical motors, have become a matter of every day occurrence. It is quite natural and appropriate therefore that the problem of electrical propulsion should again come to the front, this time with every prospect of a speedy solution.

The problem had so long been in abeyance that when Dr. Siemens set up his electrical merry-go-round in Berlin last year, most men were disposed to look upon him as the propounder of a radically novel idea, and the electric railway as the product of the latest speculative thought in this direction. And when Mr. Edison adopted the system for practical use not a few people thought that he had switched off from the line of practical work to play with a novel toy, the outcome purely of his experiments in electric lighting.

The electric railway, however, is not a plaything. It is a practical reality, though just now entering upon the stage of useful and economical development. It opens a field of invention and improvement as wide and profitable probably as was opened up by the first steam locomotive; and we have no doubt that during the next fifty years it may work as great changes in the processes and economies of life as steam railways have during the half century just past.

On the little electric railway set up by Dr. Siemens in Berlin, the locomotive obtained its power from a special electric conductor running between the car rails, the current being returned through the rails. Mr. Edison has simplified matters by throwing out the central cable as a needless expense. He makes the track itself the conductor, sending the current up one rail and down the other, the locomotive being operated by the current forming a circuit through it when proper connections are made, as described in the SCIENTIFIC AMERICAN last week.

For readers unfamiliar with electrical motors it may be necessary to say that the power for the running of the electric locomotive is generated by a stationary boiler and engine, and transformed into electricity by an electric generator at the central station. As was suggested by the elderly lady fearful of boiler explosions, the water is boiled at home, and that source of danger is removed from the list of traveler's risks. And as the efficiency of a stationary engine is several times greater than that of a locomotive engine, it is possible to convert the power of a stationary engine into electricity, transmit it to the locomotive upon the track, and there reconvert it into working force as economically as (if not much more economically than) power can be directly evolved by the combustion of coal in a locomotive furnace.

In the present stage of his experimental apparatus, Mr. Edison claims that he can realize in his locomotives seventy per cent. of the power applied to the electrical generator. The track is spiked to ties, as in the construction of an ordinary railway, and the loss of electricity in transmission is not more than five per cent., even when the track is wet. If there is no error in these figures, and we see no reason to suspect them, the economy of the electric railway is established. Its apparent advantages over steam roads are numerous. In the first place, the locomotive is light, comparatively inexpensive, and does not require a fireman or a skilled engineer to run it. The lightness of the locomotive greatly relieves the track, which need not be nearly so strong and heavy for a given service. The wheels of the locomotive can be given any desired traction upon the rails, so that a light engine can pull a train up grades which are entirely impracticable with the ordinary locomotive. The track may therefore follow any ordinary road; and when the road is used purely for freighting, as in conveying ores from mines, the road may run where other roads would be quite impracticable.

For city use, the electric railway promises to be exceptionally useful, both for the conveyance of passengers and for carrying packages. Cars propelled and governed by electricity might supersede horse cars on the surface roads; and, even if no cheaper, the sanitary advantages of the electric road, resulting from the disuse of horses, would be considerable. Indeed, it is not impossible that the city of the future may dispense with horses entirely for general trucking as well as for passenger traffic, the roadways being laid with numerous lines of flat rails transmitting the power required for propelling carriages of every sort. The absence of noise, dust, friction, and the inevitable filth attending the use of horses, promises in the new dynamo-electric period a wonderful mitigation of the present evils of city life. On the elevated roads the lighter electric engines would be comparatively noiseless, and, unlike steam locomotives, would not be constantly pouring into the air sparks, cinders, and other offensive products of combustion; and the same power which propelled the cars would light them.

But, without attempting to forecast the distant future, it is easy to foresee abundant immediate applications of the new, silent, wholesome, and economical method of transmitting and applying energy. The mining regions of the West, as well as our Eastern coal mines, present unlimited opportunities for its employment in hauling ores out of the mines along the mountain ravines and over their precipitous sides. The experiment of plowing by electricity transmitted from a central generator was tried last year with encouraging success. The same plant would answer for the operation of cultivators and harvesters; and with a light, movable railway track, the same power would suffice to do the heavy hauling incident to farm work; and one of the great advantages of electric carriage would be shown here, as elsewhere, in the facility with which it can be operated from a distance. The wagon, loaded or empty, would need no driver, and could be trusted alone to pursue an even course between stations. By means of suspended cable-tracks the roughest regions could thus be safely and economically traversed either by small passenger cars, mail bags, or freight carriers; and the constant flow of evenly distributed small loads along such a line would aggregate as large a tonnage as is now transported over solid and costly roads in long but widely separated trains.

We have already experienced in the telegraph and the telephone the advantages of electricity as a carrier of thoughts and sounds. Who can tell but, when its capacities as a carrier of men and things have been fully developed, the electric telegraph and the telephone will be eclipsed in scope and utility by the electric road? Its possibilities are infinite; and it is the disposition of the men of these days to crowd the possible in every direction.

DEEP MINES IN NEVADA.

The depth attained is as follows: The Utah 1,980 feet, the Sierra Nevada 2,500, the Union Consolidated, Mexican, and Ophir, each 2,500, Consolidated Virginia and California 3,300 each. Best and Belcher 2,000, Gould and Curry 2,200, Hale and Norcross and Savage 2,400, Chollar 2,400, Ward vertical shaft, 2,168, Combination shaft 2,440, Yellow Jacket 3,000, Belcher 3,000, Crown Point 2,800, Overman and Caledonia each 1,900, Alta and Benton each 1,950, Silver Hill 1,300, Consolidated Imperial 2,800, Bullion 2,300 feet.

FOOD ADULTERATION.

The Chicago *Inter-Ocean* introduces an official report of an examination of the vinegar sold in that city, with the startling headlines: "*Adulterated Vinegar. Results of Analyses of Twenty-four Samples by the Health Department Chemist. Discovery of Foreign and Unwholesome Ingredients Wholly Unfit for Food.*"

Nothing short of wholesale and dangerous adulterations could be looked for under such a heading; an expectation, we are happy to say, not at all justified by the report which it covered. After a number of preliminary statements with regard to the specific gravity, color, odor, etc., of vinegar, the chemist says:

"Vinegar should contain at least three per cent. of acetic acid. Three samples, Nos. 9, 10, and 22, do not come up to this standard, and should therefore be looked upon as adulterated.

"Here, again, I find sample No. 22 has been adulterated by the addition of hydrochloric (muriatic) acid, and its use should not be permitted. The vegetable acids, as I have termed them, are not necessarily hurtful.

"The examination for the poisonous metals, lead and copper, was made in the acid solution of the ash of the vinegar. It has been exceedingly carefully conducted, as it is well known that the habitual use of any food or drink, containing even very minute quantities of these metals, has a very deleterious effect upon the human system. Sample No. 17 is the only one containing a dangerous metal, namely, copper, and its sale should at once be prevented.

"Looking at these samples of vinegar as a whole, they are very good, and will compare very favorably with the general run of vinegars. No objection can be taken to any but those that I have already individually mentioned, namely, Nos., 9, 10, 22, and 17."

That there should be four objectionable samples of vinegar out of twenty-four, is certainly to be deplored; still more that one of the four should contain a trace of copper, due probably to the use of improper utensils in making or handling the vinegar. But is it not even more deplorable that a reputable newspaper will cater to popular ignorance and prejudice, and intensify them, by such misleading displays of lying type?

We are much inclined to believe that, in the majority of cases, the general adulteration of food-stuffs by grocers and manufacturers, as charged by certain uncritical writers, will be found to rest upon as small a basis of fact as the *Inter-Ocean's* alleged "war upon vinegar venders" by the Chicago Board of Health.

THE AMERICAN CHEMICAL SOCIETY.

The May Conversazione of the society was held at the University building, Washington Square, on Thursday evening, May 20. Among a number of very interesting exhibits, the following are worthy of notice:

Dr. Arno Behr exhibited a solution of copper sulphate,

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containing an abundant growth of filamentous fungi. This solution contained about three and a half per cent of ordinary pure copper sulphate; and the fact that copper salts are usually considered inimical to living organisms makes this exhibit interesting.

The same gentleman also exhibited a remarkable leather-like deposit found in a dust flue of a sugar refinery. It was made up of layers of filamentous tissue, and was probably formed by the growth of fungi, which exude a kind of glue-like material that cements the various layers together. This material was quite tough, like thin leather, and of a nut-brown color. It often occurs covering a surface several feet in area, and has the appearance of a coat of paint.

Some black scale from the interior of the retorts used in making bone-black was also exhibited by Dr. Behr. This material appears to eat into, and, finally, through the retorts, making it necessary to replace them occasionally. It consists of some carbon, together with sulphide of iron, and appears to act by giving up its sulphur to the metallic iron of the retort, becoming reduced to a lower sulphide, which in turn acquires new sulphur from the sulphates in the bones burnt, and also from the albumen which they contain.

A filter-press of Wyelin & Hubner, to be used in laboratory experiments, was also exhibited by Dr. Behr. It consisted of a filter-press with Montejus' attachment; which latter is simply a large vessel to hold the liquid to be filtered. The liquid is forced from the bottom of this vessel by means of compressed air, from the pump attached, acting on its surface.

In answer to a question as to the kind of industries in which these presses were used, it was stated that they could be adapted to every conceivable want, and that they were now being used in the United States to filter beer.

Dr. Behr said that the advantage of this press with the Montejus' attachment was that the flow of liquid through the press was steady; while by using the simple pump press without Montejus' attachment the intermittent action of the pump often caused a turbidity in the filtrate.

A specimen of the new metal gallium made by the discoverer Lecoq de Boisbaudran was exhibited by Dr. C. T. Chandler. It was only a few millimeters square, but was interesting as the first specimen seen in this country. It is a hard white metal, melting at the heat of the hand.

Dr. Chandler also exhibited a specimen of naphthaline taken from the main leading from the retorts to the gasometer of the Municipal Gaslight Company. This company makes gas by passing steam over red-hot anthracite coal, and the resulting mixture of carbonic oxide and hydrogen is carbureted by passing it through petroleum naphtha, and then through red-hot retorts again. The naphthaline deposit exhibited shows the conversion of the hydrocarbons of the paraffin series into those of the aromatic series by heat.

Prof. A. R. Leeds, of the Stevens Institute, exhibited a beautiful piece of glass work by Prof. Richards, of the Massachusetts Institute of Technology. It consisted of a very ingenious regulator, to maintain a constant temperature in a hot-air oven for laboratories. It was made entirely of glass, and much admired for its fine finish. Dr. Leeds said that this apparatus worked very satisfactorily.

ARTHUR H. ELLIOTT,
Recording Secretary.

OYSTERS AT QUINNIPIAC.

The original purchasers of the territory of New Haven County, Conn., found a tribe of Indians on the ground called Quinnipiacs. In selling to the English they still retained their rights to fishing and hunting. The river Quinnipiac, which is the eastern boundary of the city of New Haven, had long since been a famous place for oysters. These bivalves were also abundant along the shores east and west of New Haven. The Indians had depended much upon them for food. The new settlers did the same also. The banks along the shore are lined, several feet deep, with shells left by many generations of oyster eaters.

The shore at Fair Haven, which is the eastern part of New Haven, was once a favorite resort for seals. To the excited imagination of the first white settlers these aquatic beasts seemed like "dragons," hence they named the locality "Dragon," a title it long held. The present name is explained in a letter written by Rev. John Davenport, first minister at New Haven, to Lady Mary Vere, in England, in 1639. "After ye ship came in, guided by God's own hand, ye sight of ye harbor did so please ye captain of ye ship and all ye passengers, that he called it the Fayre Haven."

For nearly two hundred years the dependence of the people seeking this shore of Long Island Sound with its bays and estuaries for oysters, was upon the natural supplies. These seemed inexhaustible, as the habits of use then were. The Indians who came from the interior at certain seasons and remained for weeks, living mainly upon shell and other fish, carried none away with them. The whites only visited the shores for an occasional "salting." No restraints were imposed by the towns until about one hundred years ago. Then, and for many years, the restraint was only upon certain very accessible localities and for certain months.

As most of the oysters gathered were taken from ground left bare at low water, or in very shallow water, no special ingenuity or skill was called out in obtaining them. It being found that these shallow water beds were unreliable, deeper water was sought after a while. Cold weather often killed the oysters left bare by winter tides. Storms covered them with sand. Moreover, increasing numbers of people seeking oysters soon cleaned the beds that were so easy of access. Then invention and mechanical skill were active in contriving rakes, boats, etc., to enable the oystermen to secure a supply. It would greatly interest the archæologis to visit one of these shores and note the specimens of contrivance and art to facilitate the taking of bivalves.

One of the results of an increasing love of oysters was the growth of a class who sought a livelihood by selling as well as catching these shell-fish. Hence a business began to be developed. But there were no private grounds. The various natural beds were open to all persons in the State who wished to take oysters therefrom. The only restriction put upon the people was the reserving of several months as "close" months each year, during which no oysters could be caught. These were the summer months, when the bivalves were known to be giving off their spawn.

The "law was off," as the expression was, about November 1st. In anticipation of that time great preparations were made in the towns along the shore, and even for twenty miles back from the seaside. Boats and rakes, and baskets and bags were put in order. The day before large numbers of wagons came toward the shore from the back country, bringing hundreds of men with their utensils. Among these were not unfrequently seen boats borne on the rigging of a hay cart, ready to be launched on the expected morning. It was a time of great excitement. So eager were men to be first on the ground that many could not wait till morning dawned. As soon as the clock tolled the midnight hour a great number of men rushed to the shore and into the boats and began operations. In a few hours the crowd was such, on some beds, that the boats were pressed close together. They were all compelled to move along as one, for none could resist the pressure of the multitude. The more thickly covered beds were quickly cleaned of their bivalves. The boats were full, the wagons were full, and many had secured what they called their "winter's stock" before the day was done. Those living on the shore usually secured the cream of the year's crop. They knew just where to go, they were better practiced in handling boats, rakes, etc.; they formed combinations to help one another.

That first day was the great day. It presented an exciting scene. Often crowds of spectators came to look on, as at a fair or Fourth of July parade. Sometimes in the pushing, crowding, and eagerness of getting there, would result wrangles, and even fights; but generally the men kept good-natured and made the best of all the discomforts and hardships of the day's crabble. The oysters were very poor then compared with what are now obtained. Such indiscriminating raking caught them before they were half grown Nor were there many to be caught after that first day. In a week or two later a bushel of oysters could not be bought for less than four dollars.

It was apparent to thoughtful minds that a new policy must be pursued if the people were to continue to have oysters. There were fitful gleams of hope as new beds were occasionally discovered. But the same process of speedy exhaustion followed. Some tried to preserve what they had obtained until they grew larger by laying them down again. But all oysters found in the water were treated as common property. Whoever found them felt free to help himself. Two young men having gathered a few hundred bushels, spread them on the flats near where they lived at West Haven. They tended them carefully, hoping to realize quite a sum as a reward. Just as they were bargaining to sell them a plot was carried out thus: Several parties came from ten miles in the country, by night, with rakes, baskets, and wagons, and carcried the oysters all away. When the owners sought their property in the morning it was far on the road to the cellars of certain persons in Woodbridge and North Orange.

For thirty years past efforts have been persistently made to enable men to own ground under water, that they might preserve and grow oysters. Considerable progress has been made through both legislative and town acts. But it has been a slow and difficult process. People have been very reluctant to grant to individuals what they felt should be reserved for all. The towns of New Haven County and the State of Connecticut are at present most forward in measures for encouraging oyster farms under their waters.

The Quinnipiac River, New Haven Harbor, and the waters adjacent have for some years been all assigned to private parties.

The first use made of such grounds was to lay down oysters brought from other waters, especially Southern bays. A very large trade grew up in Virginia and Maryland oysters, brought to Fair Haven to be opened and sold over the New England and other Northern States. For some late years as many as one million bushels have been brought annually to this place from the South. Such oysters are greatly improved by even a few weeks' feeding in the waters of our bays and river mouths.

Formerly these oysters were sent around to private houses to be opened. Different members of the family, men, women, and children engaged in this work. A large part of the rapidly growing population found remunerative employment in this way. In later years shops have been built along the shores, in which this work is done. Still later, many oysters are opened on the Southern shore before being brought North. These opened bivalves were first put up in small wooden kegs, holding from one to two gallons each. They were shipped to different parts by railroad or stage or private teams. Before the building of the New York and New Haven Railroad the dealers sent large teams, drawn by two and four horses, loaded with these little barrels of oysters, as far west and north as Albany, N. Y. Of course this could be done only in the colder months. While still using the same means of packing, other forms have been introduced. The most common receptacle now is a strongly made tub, with a lid which securely fastens. Each, containing a number of gallons, is furnished with handles, with which it can be easily lifted. In warm weather ice is put in with the oysters. Tin cans are used to a considerable extent. These are filled and soldered, then packed in wooden boxes with ice between. Thus, as with the tubs, oysters are carried long distances in good condition even in summer. Several ingenious contrivances have been patented that are in use to pack, fasten, carry, and preserve this widely popular article of food. An extensive tub, barrel, and pail making business is carried on in Fair Haven itself.

Perhaps the most important changes and improvements are now being made. Necessity has compelled the oyster-man to learn many things. As in nearly everything besides, it is found that natural sources of supply are not adequate to the increasing demand. Hence the great attention is directed to the duty of artificial production. The oyster is wonderfully prolific. Each mother sends out millions of her young every season. How to secure this increase from destruction, that it may grow to be useful, is now the study. This involves the necessity of having suitable ground on which the young will "set," can be protected from enemies in the water and out of it, and still be within reach of the cultivator. The old methods have mostly "had their day." The conclusion reached is: that cultivation must be the great resource; it needs deep water for assured success, and if must have the aid of steam power. All these results are being successfully worked out in the Fair Haven oyster industry. There are serious natural obstacles, and some artificial. Among the latter I would name injudicious, because hasty, legislation. This hinders instead of fostering enterprise. But as our citizens become more satisfied of the value of this means of food supply that obstacle will disappear.

Among the natural I would name, first, *the expense.* A deep water planter must have a large amount of land; he must employ steam power; he must have a number of helpers; he must have a large market; he will be especially exposed to the ravages of "five fingers," "drills," and other vermin which are liable to assail oyster beds; he must try some expensive experiments; he will be in danger of spending much upon ground that after all may prove unsuitable.

Formerly, when there were natural sources of supply, any man with a boat and rake could start a business. Many men beginning thus have attained a comfortable competence. Now, there is not this opportunity. One must first secure a piece of ground. He must then cover it with shells, and wait for a "set." It will then be three or four years before his oysters will have grown large enough for market. Shells that once could be had for the carting must now be bought.

Oyster spawn when thrown off by the mother soon seeks some clean shell or gravel on which to fasten or "set." This is why new ground needs to be covered with clean shells or stones. Oyster spawn will not "set" on mud or muddy, dirty, or greasy matter, even if on shells. Hence shells are much in demand for preparing new ground. Shell lime has become more costly, because shells have risen in price. Once they cost the lime makers nothing.

All shell-fish are improved by an infusion of fresh water. This explains the superiority of the shell-fish of the northern coast of Long Island Sound to those on the southern coast of the same water. Many fresh water streams flow in from the north; none flow in from the south.

Oysters brought from the South, or from the deep waters of the Sound are usually quite salt, and should spend a few days in fresher water to be in good condition. Cultivators now have "floats," which are rafts of timber, in which they place their oyster near or within the mouth of some river for a short time before using. One reason of the fine flavor of Fair Haven oysters is the flow of fresh water from the Quinnipiac, Mill, and West rivers.

Changing oysters from their place of "setting," in a year or two, benefits them. They have more room and take a better shape.

Cultivation has greatly increased the supply of good oysters. In New Haven, ten years ago, it was difficult to secure ten bushels at short notice. Now five hundred bushels can be obtained in a few hours.

Two causes are giving cultivation here a new inspiration: the recent laws in Virginia and Maryland, which are likely to greatly diminish the supplies from the South, and the great call for seed oysters to be taken to Europe.

Science is giving much assistance toward understanding the nature, habits, needs, and possibilities of the oyster as a means of food supply. It has also greatly facilitated the invention and construction of machinery for the prosecution of the oyster trade. Prof. Verrill, of the Peabody Institute in New Haven, has done good service to the cultivators in this vicinity as well as elsewhere. All feel that the business is only in its infancy as yet.

The Human Retina.

In a recent note to the Vienna Academy, Herr Salzer offers an estimate (based on numeration) of the probable number of optic nerve fibers and of retinal cones in a human eye. The number of the former he supposes to be about 438,000, that of the latter 3,360,000. This gives seven or eight cones for each nerve fiber, supposing all fibers of the optic nerves to be connected with cones, and equally distributed among them.

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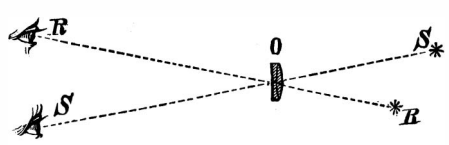
BINOCULAR VISION IN TELESCOPES.

BY CHARLES B. BOYLE.

Carefully executed drawings of the double-eyed comet seeker and large binocular equatorial were submitted, a few years ago, to the late Prof. Henry, of the Smithsonian Institution, with a view to having their practical value considered by our government authorities. Prof. Henry returned them accompanied by a written report, transmitted to him by the astronomer then in charge of the Naval Observatory, in which the latter asserted that "the construction of a comet seeker on the proposed plan would be impossible," while this very comet seeker had been in existence as a complete success for seven years preceding the date of the report, in which it was also asserted that "the great binocular equatorial would be doubly expensive and with no advantages over the usual form." In the letter accompanying the report, however, Prof. Henry expressed his non-concurrence in the views it announced, which we shall now see were advanced by one who, though in position to slam the door in the face of national progress in this respect, must have been wholly unfamiliar with the optical nature of such instruments.

The instrument known in astronomy as a *comet seeker* is much shorter in proportion to its aperture, or diameter of object glass, than those used for ordinary purposes; the one herewith presented having an aperture of six inches and a focal length of four feet two inches, while a telescope of like diameter, built for ordinary observation, will seldom have a focal length of less than seven feet six inches. The object of making the comet seeker so relatively short in focus is because the images formed in its field of vision are brighter in proportion as its focal length is short in comparison with the width of its objective or object glass. In such telescopes an object would be visible whose light would be too feeble to be seen in the field of an ordinary instrument. As a rule, therefore, it is with the comet seeker that all primary researches of the heavens are made, the persevering observer sitting night after night patiently sweeping the heavens in the hope that some feeble speck before unknown to astronomers may present itself in the field of his telescope. It therefore occurred to the writer that, as the comet seeker used up to the present time had but a single eyepiece, and therefore a single field of vision, it might be improved by an additional eyepiece and another field of vision which would bring both eyes of the observer into requisition, and as both eyepieces would be "columated" with rays coming through the center of the object glass, they would each bring into view different sections of the heavens, thus enabling the observer to keep constantly under observation double the quantity of sky that the ordinary comet seeker presented to him. This telescope is so constructed that one of the eyepieces is columated in coincidence with the optic axis of the objective, the other being situated to one side the width that a man's eyes are apart, and directed through the center of the object glass.

The only difference between the image of a star seen in the field of this eyepiece and that which is centrally columated, being that in the first the image is round, whether in or out of focus, and in the latter the star, when out of focus, throws out "a wing" to one side, but when brought into focus the image is just as bright and as perfect in shape as the other.

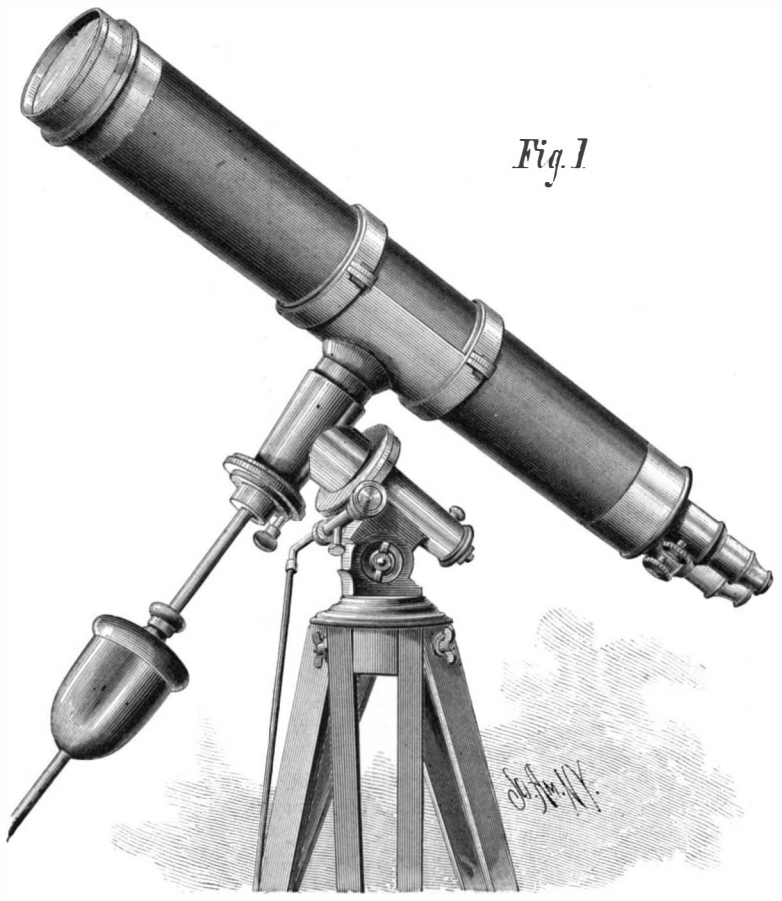


The accompanying diagram will help to explain the eminently practical nature of the instrument, O being the objective, R S stars located in different portions of the heavens, the images of which appear in the fields marked with corresponding letters. The advantage of this instrument over the ordinary comet seeker is that it enables the observer to see twice as much of the heavens, and therefore doubles his chances of finding objects; that in one hour he can search over as much area as he formerly could in two, and consequently it enables one observer to do the work of two.

The illustration, Fig. 1, represents the double-eyed comet seeker as it was constructed. Both eye pieces may be used together by a single observer, or by their proper adjustment two observers may use the instrument at the same time.

The eye-glass, A A, in illustration, Fig. 2, is "columated" with the object glass, O, that is to say, its axis is coincident with a line proceeding perpendicularly from the center of the object glass, while the eye

Fig. 1



BINOCULAR COMET SEEKER.

glass, represented by B B, Fig, 2, has its axis coincident with a line oblique to the object glass, but passing through its center; the lines of vision from the different eyes therefore converge to a point in the center of the objective, crossing each other there, and thence proceeding into space at the same angle. The two different sections of the heavens thus brought under observation form apparently a single field of view in the telescope, being visually superimposed upon each other the same as the two pictures in a stereoscope, from which it will be obvious that when an object presents itself we can ascertain which field of view it is in only by closing one eye. If a single star, after becoming visible in the field, disappears when we close the *right eye*, then we know that we have been seeing it with *the right eye*, but if it remain visible then it must be in the left-hand field, for we continue to see it, and necessarily with the unclosed eye; therefore, when a strange object presents itself in the field its position in the heavens can at once be established by the simple process of closing one eye.

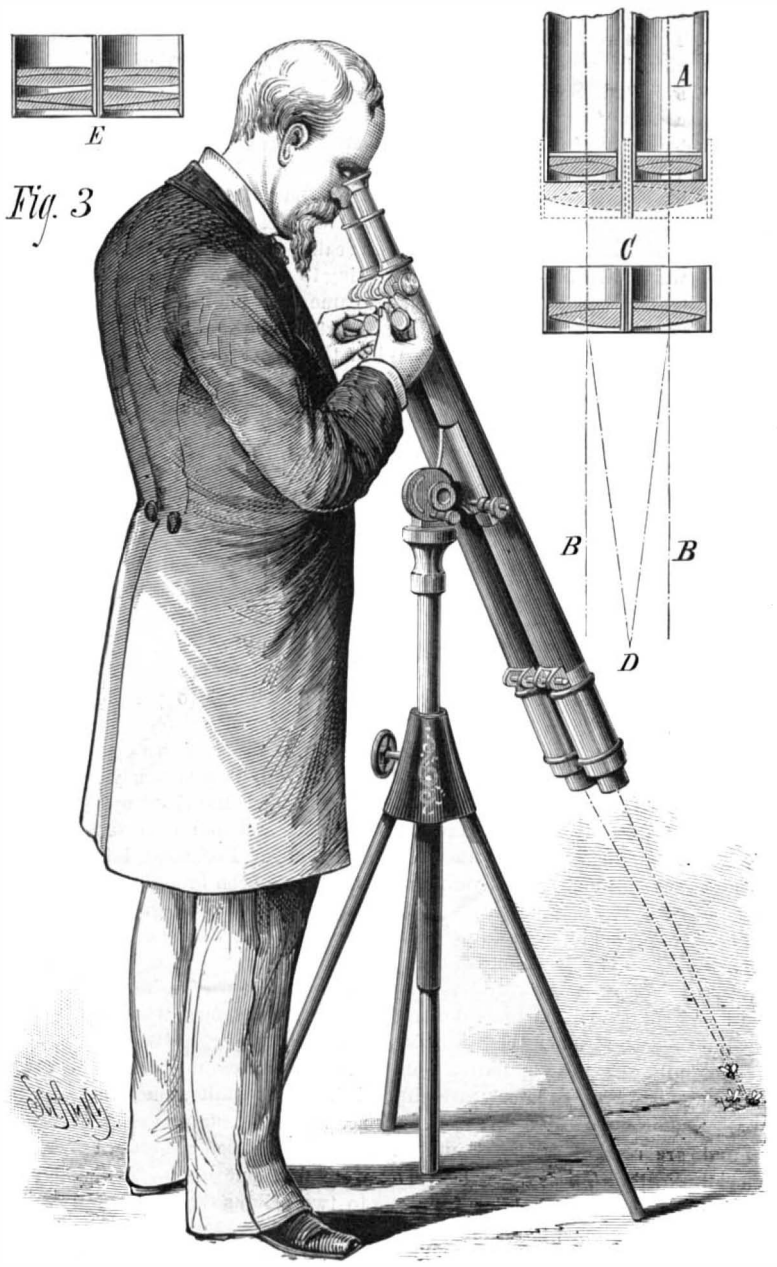
The authority who, in a written report, declared that a comet seeker, which had been a complete success for years, was impossible of construction, is not wholly reliable, though occupying a high place in the nation's trust. Let us now consider what may possibly be the merits of the great binocular telescope upon which also he pronounced sentence of extinction. The simplicity of its construction is so obvious, and the union of its binocular vision so remote from complication, that it is hardly necessary to discuss its optical qualities, as there can occur in such a structure only the positive results indicated by its combinations.

The nature of binocular vision is very little understood, because very little considered. It is now some years since I urged its claims upon a telescope manufacturer who has not his superior in the world so far as the practical manipulations of an achromatic object glass goes. He, however, repudiated the value of such combinations, declaring them worthless above the size of an opera glass, asserting at the same time that when the tubes were greater than that length they could not be adjusted so as to see a single star, and that when directed to a single star such an instrument would be sure to see two images instead of one; that, added to this defect, it would only increase the illumination by one thirteenth. Thus repelled at every point I was forced to take up the practical construction of such telescopes, and found them not only easy of adjustment, but really more than twice as luminous, for the simple reason that seeing with one eye is mutilation, and a man can no more see half as well with one eye as he can with two, than he can walk half as well with one leg as he can with two, consequently our entire system of telescopic observation up to the present time is mutilation, and a time is coming in the future when the heavens will render up to binocular vision vast resources of knowledge which will be withheld from man as long as he persists in squinting at them with one eye under the lofty impression that he knows more about the relative value of eyes than the Cause that created him.

Certainly two eyes are absolutely necessary to the proper appreciation of the form, distance and illumination of terrestrial objects, and there appears no reason why two eyes may not be as profitably employed on celestial objects.

We can readily measure the magnifying power of a single telescope as compared to the unaided eye by keeping both eyes open when viewing an object through the instrument and directly comparing the relative sizes of the images seen by each eye, but in the case of a binocular telescope this is impossible, because we have not a third eye to spare to view the object unaided, nor indeed if we had would there appear to be the slightest difference between the magnifying power of two telescopes as compared to that of one alone. The difference of illumination and amplification can only be made perceptible by referring the comparison to impressions produced upon the organism which receives them. We can make this obvious by adjusting upon some object a binocular telescope, view the object for a moment with a single eye until we have its apparent size and illumination determined as near to a positive quantity as we can, then suddenly open the eye at the other telescope, and as suddenly the image will seem to start into increased amplification quite as great as double the magnifying power would have produced upon the single eye. But the brilliancy of the image will be eight times greater, as any mathematician can demonstrate, because increasing the magnifying power to double the diameter would decrease the intensity of illumination to one quarter of its original brilliancy; whereas the brilliancy of image, in the case of the binocular, is increased to twice the original quan-

Fig. 3



BINOCULAR TELESCOPE, WITH MICROSCOPIC OBJECTIVES.

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tity, and therefore to double its original intensity. It needs no far-fetched philosophy to prove to ourselves that the brilliancy of the binocular telescope is doubly as great as that of a single telescope of like aperture and focal length, for we know that twice as much light enters two eyes as enters one, and is united by the brain in a single field. If a doubt could exist upon this point we have only to make a tube by rolling up a sheet of paper, place its end about one eye, so as to shut out all light but that which enters the tube, and direct our vision toward a plane surface in low light, for in low light we will be better able to appreciate the difference of illumination. The surface brought under examination will everywhere appear as an even tint except the portion bounded by the tube, which will come out as a bright spot upon a gray background. Independent of every other proof this fact alone demonstrates that two eyes double the illumination of all images of external objects formed on the retina; again therefore it is proved that the binocular telescope is doubly as luminous as the single one of like aperture and focal length, and as it is well known that space penetrating power is invariably proportioned to the brilliancy of illumination produced in the field of view, it follows from this *one* superior quality alone that a binocular telescope has double the value of a single one for all purposes of astronomical research. But since an amplification of the image accompanies this increase in brilliancy, we must also have the equivalent of an increase, in the magnifying power, of double that of the single instrument, and that, too, without increasing the power of the eyepiece, and consequently without any diminution of the field of view as would result from the use of an eyepiece of higher power. As it is a well known fact that all discoveries of celestial objects, and all our most accurate micrometric measurements, have been made with low powers, it follows that the binocular instrument combines all the valuable properties of the single instrument in more than double its proportions.

The great refractor in the National Observatory at Washington has a clear aperture of twenty-six inches and a focal length of thirty-two feet; another arranged for binocular vision and placed alongside of it would double the luminosity of the field of vision, and therefore have twice its space-penetrating power. A single telescope, to have the same brilliancy of illumination or light transmitting power, would require an objective of thirty-six inches aperture and to be of the same focal length. But as it would be impossible to correct such a lens to the same degree of excellency as that of one of like focal length and less diameter, a like degree of perfection of figure could not be obtained; added to this, the lens would require to be at least one third thicker, and would therefore absorb light in a like proportion. As difficulties of this kind increase in proportion to the square of the diameter of the objective, it follows that a single refracting telescope cannot be made equal in space-penetrating power to a binocular refractor having measurements in duplicate to that now in the National Observatory, and *that* as it now stands has less than half the space-penetrating power which can be given it. This could be done by simply adding a duplicate instrument, making it binocular. This, however, is not all. A refracting telescope having a light-receiving capacity equal to such a binocular would require an objective of thirty-six inches in clear aperture, but owing to the increasing difficulties of correcting such a lens it would be necessary to increase rather than diminish its focal length; but if we assume it to be in exact proportion it will then require to have a focal length of forty-five and a half feet, which at once compels the building of an observatory of correspondingly increased proportions, and expenses would be double that of the binocular instrument, while the latter would still remain vastly superior to the former. Hence, instead of being, as the preceding report of the authority from the Naval Observatory asserts, *doubly expensive*, it would not be half the expense of a single instrument theoretically its equal, though practically far inferior. The nation, therefore, stands to-day with an observatory capable of accommodating a telescope of twice the space-penetrating power possessed by the one now mounted there, by the mere expense of the additional telescope. But the way to such obvious and cheap improvement is barred by an authority capable of committing himself in writing to the positive declaration that a telescope already constructed is impossible of construction, closing the door in the face of obvious progress, through *a knowledge* of, or a *want of knowledge* of the subject, we leave the reader to judge.

The great binocular telescope which I propose is capable, without additional expense, of adjustments with which one eye receives the light direct from the telescope and the other by prismatic reflection.

Whatever may be the nature of the power which created animal life, be it sentient or the unfolding of successive causes, it would not have been so particular to endow each race and each individual of each race with two eyes if there did not lie behind it some potent reason, for nature never wastes her resources any more than she forgives self-mutilation or any another transgression of her laws.

It is but a few years ago that a gentleman left with a professional astronomer for examination one of my binoculars of thirty inches focal length; after some time the astronomer reported that in using the instrument he found he could see just as well with one tube as with both, and with one eye as with two. In looking farther into the matter it turned out that the astronomer had nearly lost the use of one of his eyes from the fact that he invariably used the other when observing the heavens through his great telescope, by which its companion had become dimmed and mutilated, finally unfitting him for the normal binocular vision of every-day life.

This same character of visual mutilation results from the use of the one-eyed microscope, and has led to an effort to construct that instrument upon the principles of binocular vision. But as another law of vision has been transgressed in the instrument produced, the effect upon the eyes is yet very unsatisfactory. In every case, however, where monocular vision is persevered in, nature will be sure to enter her protest by inflicting the common penalty.

The far-off problems of space, and many of the nearer ones, will remain unsolved until a generation arrives upon the planet sufficiently in earnest to use the resources nature has endowed them with, and who will comprehend that self-mutilation is not one of the stepping stones to wisdom.

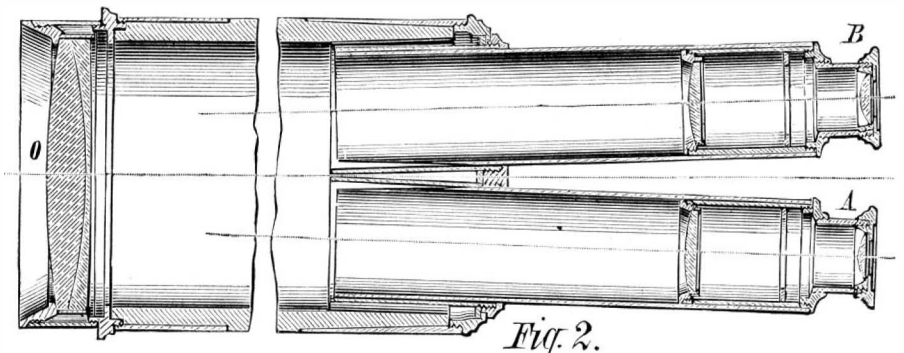

Fig. 2.

SECTION OF BINOCULAR COMET SEEKER.

We now introduce the binocular microscopic telescope, so named because, by the mere placing of a lens of peculiar construction on each tube, it is changed from a telescope to a microscope having the power of magnifying objects at distances very much greater than were before attainable, thus enabling the observer to bring under observation objects situated at distances varying from one to ten feet.

As it is mounted on a tripod it can be stationed among the grasses and having universal motion, insect life can be followed and studied in the domain of their native activity, enabling the observer stationed in his easy chair to fill the office of war correspondent to the extensive, deadly, and desperative battles of ants which so frequently occur in summer time. Thus he can watch "the busy bee" as he trowels up the walls of his cells, and to superintend the operations and habits of insect life generally without disturbing the subjects or making them even aware that they are under observation. It has, however, graver phases to the medical profession, the power to bring under microscopic observation offensive diseases of the skin, while the observer is yards away from the point under examination. When the lenses are removed which make it a microscope, it is transformed into a telescope for ordinary terrestrial or astronomical use.

Fig. 3 presents A, the objective end of the binocular microscopic telescope, in its capacity of telescope, the lines of its vision being parallel, as shown by the continuation into space of the dotted lines, B B. C of the same illustration represents two cells containing portions of a lens whose original form and relative size is shown by their curves having a common connection; they are, therefore, oblique achromatic lenses cut from corresponding parts of a larger lens whose focus is at D. When the cells, C, are placed in position over the object glass of the telescope, as shown by the dotted lines there, its lines of vision will then be directed to the focus, D, of the lenses, C. Objects occupying this focus will appear magnified in proportion to the power used. The same result can be obtained by using ordinary magnifying lenses in connection with achromatic prisms.

This instrument is not intended to rival, or in any way to trench upon the domain of the table microscope, but to meet requirements for which the latter is not adapted. The table microscope can only examine objects located at very short distances from its objective, never greater than four inches, while the microscopic telescope will magnify them at the distance of ten feet and under. The table microscope is pre-eminently fitted for great magnifying power, and though the microscopic telescope may have its magnifying power increased *ad libitum*, the work it is designed for makes it undesirable to go beyond moderate magnifying powers. In examining a battle of ants, for example, it is necessary to keep the power sufficiently low to admit a group of the combatants into the field of view. Or, when an insect is found among the grasses, in his native jungles, tending to business, very high magnifying powers would make it impossible to follow his motions, as his apparent speed would be increased in the same proportions as his dimensions. If, however, the objects be stationary, there is no limit to the magnifying power which may be used so long as the illumination is sufficient. This principal is equally applicable to the single form of telescope.

The binocular microscopic telescope has been presented before the New York Microscopic Society, and the inventor had the honor to receive from that body its official vote of thanks for progress in microscopy, so that, as in the case of my double-eyed comet seeker, it is now too late to declare its construction to be an impossibility.

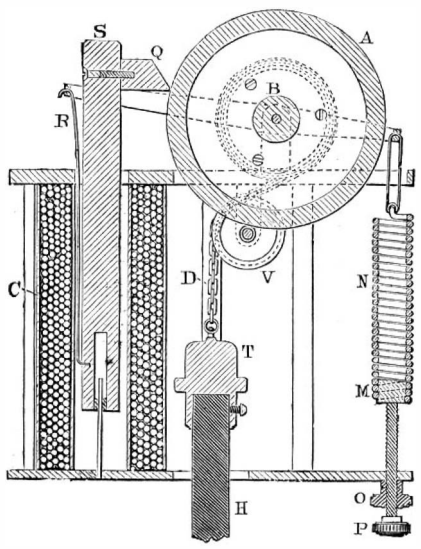

Fig. 2.—SECTION OF REGULATOR.

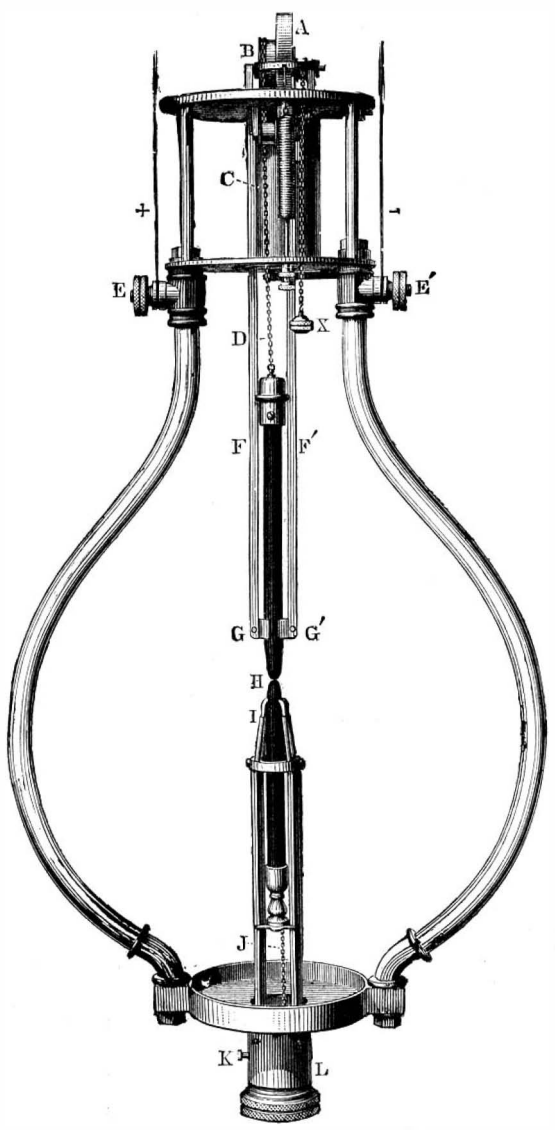

Fig. 1.—HOLCOMBE'S ELECTRIC LIGHT APPARATUS.

NEW ELECTRIC LAMP.

We illustrate herewith an electric lamp invented by Mr. Alfred G. Holcombe, of 31 Park Row, New York city. It possesses several points of novelty, and seems to be constructed on correct principles. The light is produced by means of an arc, and the regulation of the current is effected by an axial magnet having a core which contacts with a soft iron disk placed on an arbor carrying a drum on which is wound a chain connected with the upper or positive carbon carrier. The lower carbon is carried upward by a spring acting continuously, the rate of feeding depending on the rate of consumption.

In the engraving, A, is an iron disk mounted on an arbor at the top of the lamp. Upon the same arbor there is a drum, B, which supports the carbon by means of a chain, D. An axial magnet, C, at the top of the lamp contains a soft iron core, S, provided near its upper end with a beveled projection, Q, which lightly touches the iron disk, A.

The core, S, is connected with a wire, R, with a lever

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that is pivoted on the arbor of the disk, A, and is connected with a spring, N, which opposes the action of the axial magnet, C.

The chain, D, runs over a sheave, V, to change its direction, and is attached to a carbon holder, T, placed between parallel vertical guides, F F'.

The guide, F', is pivoted and provided with a spring, which tends to throw its lower end toward the guide, F, and thus clamp the carbon, H, lightly between clips, G.

The lower or negative carbon is forced upward by a spring contained in the case, L, and its upward movement is checked by the platinum fingers, I, which reach over upon the base of the cone formed by the burning away, so that the lower carbon is fed upward only as it is consumed.

The arc is formed at H. The current to operate the lamp is taken through binding posts, E E, on opposite sides of the lamp. When the lamp is in operation and in its normal condition, the beveled nib, Q, of the core, S, of the axial magnet adheres to the iron disk, A, holding the carbons the proper distance apart to produce an arc suited to the current. Should the current increase, the core, S, is drawn downward into the axial magnet, thereby separating the carbons increasing the length of the arc. Should the current diminish, the spring, N, acting through the connecting lever, raises the core, S, and turns the disk, A, so as to bring the carbons nearer together. Should the current cease, the disk, A, is entirely released, and the upper carbon, H, descends of its own gravity until it touches the lower carbon, when it is in condition to receive the current and become relit.

The upper carbon may be raised at any time by pulling on the chain, X, which is wound upon the arbor of the disk, A, in a direction opposite that of the chain, D. The length of the arc may be varied by adjusting the spring, N, so as to offer more resistance to the action of the axial magnet.

The lower carbon and carbon holder may be readily removed from the lamp frame by turning the casing, L, a quarter of a revolution. And the spring actuating the carbon carrier may be stopped by pressing the button, K, when it is desired to put in a new carbon.

The lamp seems well calculated to avoid the imperfections found in other lamps. It gives a steady, strong light, with arc always in the same position. There is no lost mechanical motion, and the regulating mechanism absorbs an amount of energy equivalent to but one candle power of the current.

Why the Needle Points Northerly.

A San Francisco gentleman lately wrote to the Superintendent of the U. S. Coast Survey, Professor C. T. Patterson, asking the reason why the magnetic needle points to the north. In reply Professor Patterson wrote as follows, and possibly many more than the original inquirer may be glad to read his simple statement of the facts of the case.

The reason why the needle points in the northerly direction is that the earth in itself is a magnet, attracting the magnetic needle as the ordinary magnets do; and the earth is a magnet as the result of certain cosmical facts, much affected by the action of the sun. These laws have periodicities, all of which have not as yet been determined.

The inherent and ultimate reason of the existence of any fact in nature, as gravity, light, heat, etc., is not known further than that it is in harmony with all facts in nature; even an earthquake is in perfect harmony with, and the direct resultant of, the action of forces acting under general laws.

A condensed explanation in regard to the needle pointing to the northward and southward is as follows: The magnetic poles of the earth do not coincide with the geographical poles. The axis of rotation makes an angle of about 23° with a line joining the former.

The northern magnetic pole is at present near the Arctic circle on the meridian of Omaha. Hence the needle does not everywhere point to the astronomical north, and is constantly variable within certain limits. At San Francisco it points about 17° to the east of north, and at Calais, Maine, as much to the west.

At the northern magnetic pole a balanced needle points with its north end downwards in a plumb line; at San Francisco it dips about 63°, and at the southern magnetic pole the south end points directly down.

The action of the earth upon a magnetic needle at its surface is of about the same force as that of a hard steel magnet, 40 inches long, strongly magnetized, at a distance of one foot.

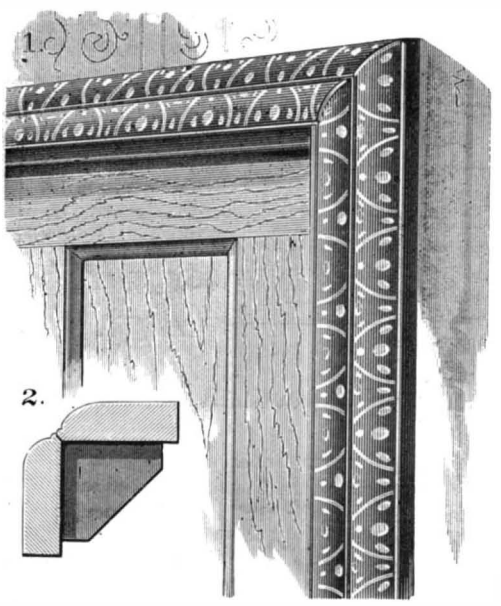
The foregoing is the accepted explanation of the fact that the needle points to the northward and southward. Of course no ultimate reason can be given for this natural fact any more than for any other observed fact in nature.

Cotton Planters' Association.

The annual meeting of the Mississippi Valley Cotton Planters' Association was held in New Orleans, May 18. The attendance was large. Resolutions were passed indorsing the Mississippi River Commission; claiming a right to representation in the National and State Cotton Exchanges; condemning the sale of cotton seed; approving the barge-line system of river transportation; and condemning speculations in cot ton futures by cotton factors. The officers elected for the ensuing year are: President, F. C. Morehead; Vice-Presidents, J. W. Vicks, Mississippi; H. R. Lucas, Louisiana; J. B. Killebrew, Tennessee; S. B. Cockrill, Arkansas; and Dr. J. B. Taylor, Alabama.

NEW STYLE OF MOULDING.

The annexed engraving represents a new style of carved moulding recently patented by Mr. H. D. Benjamin, of De Ruyter, N. Y The moulding, although quite simple, is very ornamental, and may be applied to doors, windows, cabinets, bookcases, and many articles of furniture. It forms an elegant corner for secretaries, and may be modified to adapt it to a great variety of uses. A ceiling cornice made of this style of moulding gives a finished appearance to the ceiling and walls. This invention relates more to the method of carving or ornamentation than to the particular shape of the moulding, and the carving may be varied to adapt it to different forms of moulding.

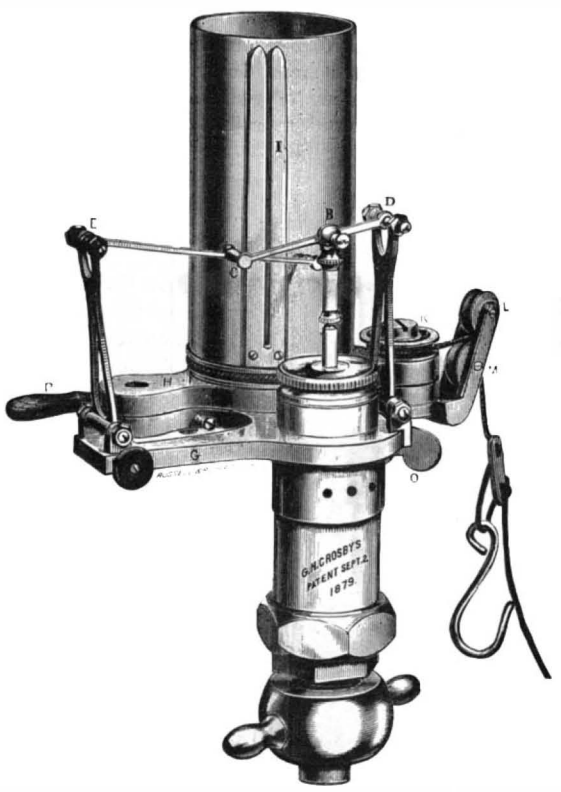


BENJAMIN'S IMPROVED MOULDING.

Further particulars may be obtained by addressing the inventor as above.

THE STEAM ENGINE INDICATOR.

The steam engine indicator is designed to register automatically upon paper the pressure of steam in the cylinder at every point of the piston's stroke. The form of the diagram thus drawn by it affords information of a variety of facts not otherwise readily obtained. It is now generally conceded that the indicator is an invaluable appendage to the steam engine, and when properly applied and understood, cannot be too highly estimated. The efficiency and economy of every engine made or sold ought to be proved by the indicator diagram. In fact, no builders of first class engines now consider their canvass complete without showing a facsimile of the diagram of their engine.



CROSBY'S STEAM ENGINE INDICATOR.

Our engraving represents a Crosby indicator, which is probably the most perfect instrument of its class yet devised. The principle and action of indicators are so simple, and to most practical engineers now so well understood, that it will only be necessary to give the accompanying cut and description of the parts of this instrument to readily appreciate the advantages accruing from its use.

A is a case or jacket inclosing a cylinder, into which a piston is nicely fitted to move without friction; to the upper side of this piston is attached a steel helical spring, the upper end of which is fastened to the cap or head of the cylinder; to the upper end of the piston rod, B, is directly jointed the short lever, C D, whose short end is jointed to the head of a vibrating standard at D, and its long end is jointed to the long lever, E F, at the point, C. The long arm of the lever, E F, is jointed at its outer extremity to a second vibrating standard at E, and to the other extremity is attached the pencil, F. To the case, A, is permanently attached the horizontal plate, G, at one end of which is jointed a corresponding plate, H, situated above the former and carrying the revolving drum, covered by the paper cylinder, I. To this drum is attached a cord, wound around a groove at its base and carried by the guide wheel, K, between the two extra guide wheels, L and M; the guide wheels, L and M, are attached to the arm, N, which swivels around a point in line with the axis of guide wheel, K, and is held in its proper position by the thumb nut, O. The drum carrying the paper cylinder, I, is rotated in one direction by the tension on the cord, and in the reverse direction by the reaction of a spring inclosed therein; the tension upon this spring may be adjusted to suit by the thumb nut at the open end of the drum. The plate, H, carrying the drum and paper cylinder, is held away from the pencil, F, by a spring situated between the plates, H and G, directly in line with the axis of the drum, until the operator desires to take a diagram. By pressing upon the handle, P, the paper cylinder is moved forward and the pencil comes in contact with the paper. Immediately upon removing this pressure the paper cylinder automatically assumes its former position. Two adjustable stops determine the amount of this motion and regulate the force with which the pencil presses upon the paper, a hair line being attainable without friction. The bushing which carries the pencil is bored to receive a graphite or metallic wire, and is supplied with means for holding it in any position desired. The piston rod is bored at each end almost half its length, leaving a thin partition or stop in the center; the upper chamber is used as a reservoir for a lubricant, and is provided with pin holes close to the partition to allow the oil to flow out and down, and so lubricate the rod and piston; the lower chamber allows the steam to enter and warm the lubricant, causing it to assume a more limpid form and flow freely in cold weather. The piston rod is thus made lighter without weakening it materially.

The pencil in this indicator is situated close to the piston rod, instead of projecting several inches to one side, as in other instruments of this class, and the paper is moved up to the pencil, instead of moving the pencil up to the paper, as heretofore. The parallel motion is new and perfectly true. There is a hot air chamber or jacket around the steam cylinder instead of steam chamber.

It is claimed that this indicator is free from some very objectionable features prominent in other makes. Friction always causes errors in registration, but at the same time it admits of drawing the diagram even and smooth, and deceives the operator into the belief that he has got a good diagram, while the reverse is true.

The manufacturers of the Crosby indicator have aimed by all possible means to avoid friction. The motion of the pencil in this indicator is always a uniform multiplication of the piston motion. The weight of reciprocating parts is reduced to the minimum, and the parts which require constant lubrication, such as the cylinder, piston, and rod, are automatically oiled.

This instrument is more easily operated than indicators in which it is necessary to be to some extent an expert, with a delicate sense of touch to determine just the proper force to employ in moving the pencil against the paper so as not to tear it or cause undue friction. In this indicator all this is pre-arranged so accurately that it is said a child can operate two indicators—one at each end of the engine cylinders—simultaneously, without difficulty, and obtain hair lines without friction. When properly adjusted, connected, and operated, diagrams made by this instrument may be implicitly relied upon. For further information address the Crosby Steam Valve and Gauge Co., corner Milk and Batterymarch Streets, Boston, Mass.

Novel Use for Empty Cans.

The works of the Duquesne Smelting Company—a Pittsburg enterprise—are located at the mouth of Sacramento Gulch, near Leadville, Col. A few weeks ago Superintendent Tate ran short of ore suitable for "flux," and was saved a great deal of worry by the proximity of an immense deposit of empty tin cans. Canned fruit, meat, and vegetables, it should be stated, are the mainstay of Colorado cooks. The back yards and waste places about Leadville are covered with millions of empty cans of every form and size. Superintendent Tate ordered a squad of Chinamen and two big charcoal wagons to the can pile, and soon had his smelter running on ore and tin cans. The latter supplied the needed elements, and the Duquesne will not run out of "flux" while there is an empty can in Leadville.

Patent Office Items.

Mr. Edison has just obtained a new patent for improvements on his original phonograph, by which the machine is made to speak to better advantage than ever before

A machine for making pies has lately been patented. This, taken in connection with the patent substitute for eggs, will be good news for boardinghouse keepers.

After a long contest with many other claimants, Mr. Emil Holtzmann, of Germany, has received a U. S. patent for the copying process now so extensively used, by which many copies of letters are taken from a sheet of soft glue. The patent is dated May 18, 1880, No. 227,629. It was patented in Germany in 1878.

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Correspondence.

Fungi on Glass.

To the Editor of the Scientific American:

In the last SCIENTIFIC AMERICAN I saw an account of "Household Fungi," said to be found on glass, exhibited at the Microscopical Club of Buffalo. As I have made glass a subject of study for about twenty years, and entered a glass store as a boy forty years ago, I am desirous to know more about the glass referred to. I never saw or heard of any "fungus" on glass, but I have often seen what we call rust or stain on the surface, and that is, I think, what was observed. It is an efflorescence upon the surface occasioned by an excess of soda or potash in the composition of the glass. It can be removed from the surface by the skillful use of hydrofluoric acid.

The reason why similar appearances were found on glass in other places is that it was probably of the same kind, having an excess of uncombined alkali, which, having an affinity for moisture, effloresces and forms a coating, which can only be removed by acid. If it were indeed a "fungus," I think it could be easily removed by soap and water. That it could not be thus removed proves conclusively to me that it was the ordinary rust or stain, which so frequently troubles the glassmakers. If it be rust, it is no new phenomenon, but one which is noticed on all the old Greek and Roman glass exhumed from the ruins of old cities, whose iridescence charms us in the museums of Europe and America; and this same rust has often been removed from the windows on which it has appeared in public and private buildings, by workmen in my own employ, by the skillful use of acid. This stain, in some cases, presents such peculiar shapes and colors, that it has given rise to all of the ridiculous stories of portraits of deceased friends impressed upon window panes by the action of lightning.

Boston, May 18, 1880. THOMAS GAFFIELD.

[Prof. J. W. Ward, to whom Mr. Gaffield lately wrote, substantially as above, informs us that, in view of Mr. G.'s suggestions, he has re-examined his patches of fungi, and is satisfied of their vegetable and superficial nature. But the statement in regard to their removal he thinks is a little too strong. They do in fact defy the action of soap and water; but rubbing with a pine stick and subsequent polishing with a cloth will, says Prof. Ward, remove them completely and leave no trace behind. Prof. W thinks that the rust mentioned by Mr. Gaffield is not very often seen except by close observers like himself.—EDS. SCI. AMER.]

Fungi on Glass.

To the Editor of the Scientific American:

In the paragraph on page 320 of your journal for May 22, 1880, making mention of my note on a curious fungus discovered on some picture-covering glasses hanging on the wall of my house, there is a little inaccuracy, which, of course, is not chargeable to you, but to the reporter who collected the item for his journal. I exhibited the fungus, which covers several similar glasses in my sitting room, as a curious production; and after making some remarks on its peculiar characters, said further that I had noticed another but *different looking* fungoid growth occurring in somewhat similar spots scattered over the glass in the windows of the Grosvenor Library. Prof. Kellicott stated he had seen what *might be* the same thing on the windows of the Central School and City Hall.

My suggestion in relation to *these* growths, that is, such as were discovered on the windows of these public places, was that they might be due to human exhalations or confined breath; that those found on the glasses in my own house, which were *quite different* in form, had such an origin, I particularly stated, I did not feel satisfied, though it might be possible. I am not prepared to name either of these fungoids. That found on the windows of the library is small, yellowish-gray in color, densely arachnoid, with a distinct annular boundary, and variable in size. The one in the dwelling room belongs to the group of white rusts, *Perisporiacei*, something like an *Erysiphe*, but still more regularly defined, and without a nodular center. It is radial, dichotomously branching, white, circular in outline, the dichotomous terminations of the branchlets free, the whole flatly adherent to the glass, the surface of which it almost entirely covers with its thread-like disks.

JAS. W. WARD.

Buffalo, May, 1880.

Seeing by Electricity.

To the Editor of the Scientific American:

Your article on "Seeing by Electricity" contained in the SCIENTIFIC of June 5, page 355, will prove of interest to many. Early in the fall of 1877, the principles and even the apparatus for rendering visible objects at a distance through a single telegraphic wire were described at No. 21 Cortlandt Street, in this city, to James G. Smith, Esq., formerly superintendent of the Atlantic and Pacific Telegraph Company, and now of the Continental Telegraph Company, I believe, and to Messrs. Shaw & Baldwin, telegraph constructors, also, I believe, now connected with the Continental. At that time I was engaged in perfecting an autographic telegraph by which maps and pictures were daily transmitted by telegraph over a single wire.

The recent announcements of this discovery in three different directions, each undoubtedly independent of my own experiments, show how the same idea often occurs in separate minds. There is no likelihood of any plan of this kind ever being reduced to practice, for some of the difficulties in the way of all of the plans are insuperable, as will be apparent from the following reasons:

1. The action of light upon selenium in changing its electric conductivity is slow; although new discoveries may remedy this feature.

2. To convey with any accuracy an image, one even so small as to be projected upon a square inch of surface (I am speaking now of the apparatus you describe), would necessitate that this surface should be composed of at least 10,000 insulated selenium points, connected with as many insulated wires leading to the receiving instrument; for the variation of the one-hundredth of an inch either way will "throw a line out of joint."

3. The most delicate apparatus would not indicate a change in resistance by the projection of light upon merely a selenium point.

4. Isochronism is unattainable, as required. The method I proposed involved the isochronous movement of the separate instruments. The transmitter consisted of a coil of fine selenium wire in a darkened case, having a diameter of say three inches. Light from the image to be transmitted was to be let into the chamber and upon the selenium coil by a fine tube which, starting at the periphery of the circle, would draw concentric imaginary spiral lines until reaching the center of the circle. Thus light emitted or reflected from the image to be transmitted would affect the selenium just in proportion to the brightness of the image at the different points within the compass of the circle traversed by the imaginary lines drawn by the opening in the tube. The speed of motion of the tube was to be such that in describing all the spiral lines from the periphery to the center of the circle, the impression made upon the retina while at the periphery of the circle would not have ceased until the light ray should have reached the center of the circle.

The receiver consisted of a darkened tube, having an inside diameter of three inches (corresponding to the transmitting circle), with its sides and bottom absolutely black. In this tube, describing imaginary lines just as the tube in the transmitter, was a blackened index carrying two fine insulated platinum points very close together connected with the secondary wire of a peculiar induction coil, the primary wire of which constituted a part of the main wire leading to the transmitter.

The transmitting ray of light and the invisible index in the darkened receiving tube were to start at the periphery and describe their spiral motions in exact unison until the center should be reached, and the speed being sufficiently great it is obvious that as the first spark between the receiving platinum points would not have ceased to affect the retina until the last spark, with the index at center, would have been produced, an exact image of the object before the transmitter would be reproduced before the eye of the observer placed at the darkened chamber of the receiver.

But the trouble is to make the selenium sufficiently active, *and to get the isochronous motion.* Perhaps some of your readers may like to try their hands at rapid synchronism.

W. E. SAWYER.

New York, June, 1880.

A NEW MOTOR.

One of the great wants of the day is a motor for small machinery, which shall avoid the danger and inconvenience of steam. This is accomplished in the Tom Thumb caloric engine, recently patented, which makes use of the expansive force of heated air alone. Its success is based on employing

THE TOM THUMB CALORIC ENGINE.

a comparatively low temperature—250° to 300° Fah.—producing a pressure of four to five pounds per square inch, and operating on a broad diaphragm piston of relatively short stroke. The piston is formed of two circular metallic disks, having between them a flexible diaphragm composed of a layer of vulcanized gum elastic sheet, and over this externally a layer of canvas, which protects the gum and prevents it from yielding to pressure. A clamp ring attaches this diaphragm air-tight to the rim of a dish-shaped vessel, so as to allow of a motion in the piston to the extent of about one-third its diameter. This is the working cylinder, from which, it may be observed, the boring and fitting, as well as friction incident to the ordinary arrangement, are quite eliminated. The piston box forms the upper member of the machine, the connection of piston and crank being apparent in the engine. The central part, the heater, is a tight metallic box, the interior heating surface of which is greatly increased by numerous thin plates or ribs cast in connection with the bottom and rising almost to the top nearly the whole length. The heat being applied to the bottom of the box, the lower edges of these ribs are virtually in the fire, and thus the whole are readily kept at a suitable temperature.

At the bottom is another piston box similar to the first, but larger, and having its piston below, with a valve in it opening inwards. This is the air pump, and it is connected with one end of the heater by a pipe which has an automatic valve at the lower end, opening upwards. As this piston descends it fills the box with air, which in ascending is forced into the heater, and the valve in the pipe prevents its return. The other end of the heater is connected with the upper piston box or motor by a pipe always open, the two thus forming one chamber.

The operation of the machine is thus: The heater being filled with expanding air, the motor piston is forced upward, and just before it reaches the highest point a tappet on one of the cross head guides raises a lever, pivoted on the outer frame, which lever in rising forces open a valve in the bottom of the motor box, opening a communication with the outer air, and consequently the pressure subsides, allowing the piston to descend. Soon after the main crank passes the top center two long cranks on the ends of the shaft, connected with the crosshead of the lower piston by slotted rods, suddenly collapse the air pump, blowing out the hot air from the heater and motor box through the now open valve in the bottom of the latter, and supplying its place with fresh cold air. The motor piston now descending presses and closes the latter valve, and the fresh air is confined between it and the valve below the heater, to be at once expanded for another stroke. The action of the air pump not being against any pressure, little power is consumed in it. Like other caloric engines, it is single acting, and the pulley serves also for a flywheel. The internal capacities of the air pump and heater are equal, and about three times that of the motor vessel. This is important in order to obtain sufficient pressure at a temperature so low as not to injure the motor diaphragm—the gum being vulcanized to bear about 300° Fah. The simplicity and chapness of construction of this machine will recommend it for a great variety of purposes. An engine suitable to propel a sewing machine is about twenty-five inches high by thirteen wide, and heated by an oil or gas stove. An engine forty-five inches high is a quarter horse power, while the full horse power is six feet high by three feet wide.

For further information address J. Jenkins, No. 3 South Tenth street, Philadelphia, Pa.

MISCELLANEOUS INVENTIONS.

Mr. Francis Law, Sr., of East Orange (Bloomfield P. O), N. J., has patented an improved hat-flanging machine, so constructed that the sand weights can be conveniently raised and lowered upon the flanges to press the brims of hats. The invention consists in constructing a hat-flanging machine of a frame having table and bench, a suspended sand weight, a carriage and track for carrying the sand weight, uprights, and a treadle for raising and lowering the sand weight.

An improved breech-loading firearm has been patented by Mr. George H. Fay, of Morrison, Ill. This invention relates to improvements in firearms composed of a number of fixed barrels, and to the mode of firing the arm; and the object of the invention is to give a wider range to the arm, and thus increase its effectiveness; also to arrange the firing devices so that all of the barrels may be fired simultaneously, or singly.

Mr. James O Hands, of Louisville, Ky., has patented a novel device for automatically delivering coins for the purpose of facilitating the ready making of change. The invention consists of a box or case containing a number of receptacles for holding coins of different sizes, of automatic devices for delivering the coins and sounding an alarm as each coin is delivered, or as the drawer is opened, and of novel devices for locking the drawer and the delivery slides.

Mr. Samuel M. Kohr, of Omaha, Neb., has patented a new butter package for transportation and handling butter conveniently. The invention consists of a pail containing a series of crates, formed of a number of cups for receiving the rolls of butter, mounted above each other upon a central rod in the pail.

Mr. Peter W. Nelson, of Moline, Ill., has patented a device of especial convenience to shopkeepers, whereby barrels of groceries or other articles may be supported and readily swung in and out under the shop counter. The invention consists of a vertical bar having at each end a laterally extending hook or clasp, the upper hook or clasp being vertically adjustable, said bar being pivoted above in the under side of the counter, near its edge, and below in the floor, so that it can be turned outward to receive a barrel between its hooks or clasps and be swung around to carry the barrel under the counter.

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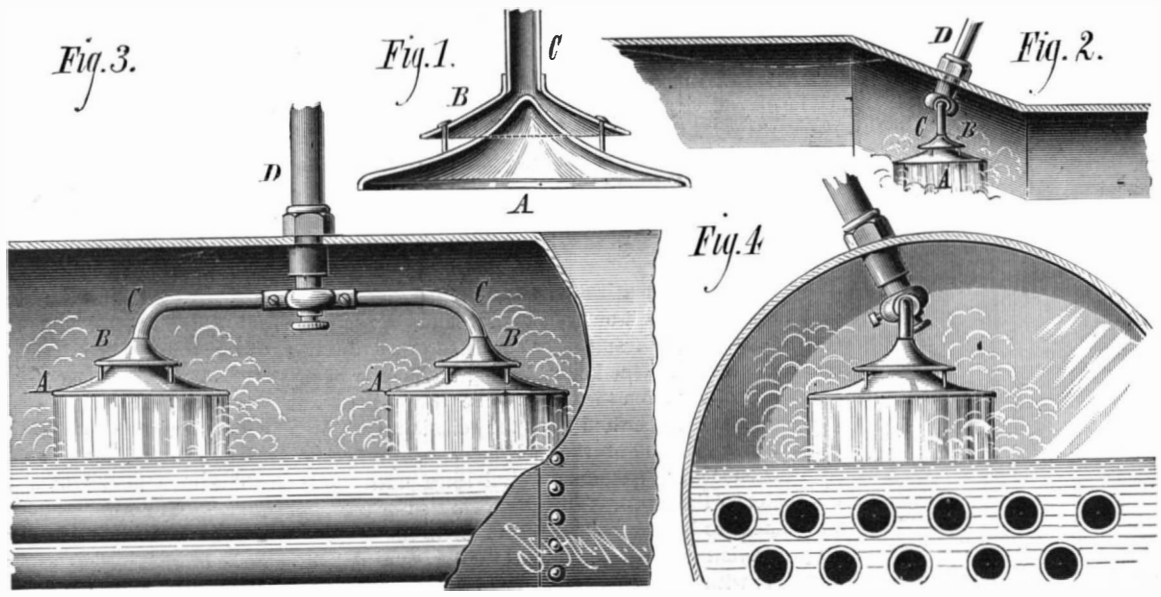
A USEFUL STEAM BOILER APPLIANCE.

Aside from defects in the construction of boilers, undoubtedly the greatest source of expense and danger is the accumulation of sediment and incrustation on the heating surfaces; and while special preparations in some instances prevent the accumulation of scale, the use of such preparations is, to say the least, inconvenient, and, as a rule, they make the water in a boiler to all appearance dirtier than it could be made by natural causes.

Our engraving illustrates a device which obviates the difficulties arising from the use of bad water, by precipitating the mineral salts and other impurities in the feed water before it joins the body of the water in the boiler. This important result is secured by allowing the water to enter the boiler through the steam space in a thin sheet or spray, which is instantly heated to the boiling point, precipitating the impurities before it reaches the surface of the water contained by the boiler. The precipitate goes immediately to the bottom of the boiler, whence it is removed by blowing out two or three times daily. This is a new departure in steam engineering, and it is looked upon with some suspicion on the part of steam engineers who have never investigated the subject, but actual experiment has proved that no more loss is experienced in introducing feed water in this way than any other, while the advantages attending this method are very great.



MOREHOUSE'S ANTI-INCRUSTATOR.

The device by which water is introduced into the boiler is clearly represented in the engraving, Fig. 1 representing the peculiar nozzle for spreading the water injected into the boiler; Fig. 2 shows the application of the device to a locomotive boiler, and Figs. 3 and 4 are respectively longitudinal and transverse sections of a cylindrical boiler provided with the anti-incrustator.

The water distributer consists of a conical plate, A, suspended beneath the flaring end, B, of the pipe, C, by three bolts, which may be adjusted so as to vary the distance between the plate, A, and the flaring pipe end, B, and thus regulate the amount of water entering the boiler. The inventor prefers to arrange two water distributers as shown in Fig. 3, the two pipes, C, being connected with a T whose shank projects through the boiler shell and connects with the feed pipe, D.

With this device, either hot or cold feed water may be used. Among the many important advantages arising from the use of this improvement, the most prominent are, the entire prevention of scale, the absence of foaming or priming, and the obviation of that class of injuries to boilers resulting from the contact of cool feed water with hot iron surfaces.

Further information concerning this useful invention may be obtained by addressing the patentee, Mr. Wm. Morehouse, 147 Mariner street, Buffalo, N. Y.

NEW CEILING AND WALL.

The ordinary method of lathing and plastering the ceilings and interior walls of buildings consists in nailing wooden laths to the joists or studs, then applying two separate coats of mortar; and, lastly, a white coat or "finish," composed of slaked lime and plaster of Paris, the latter being put in to give strength and solidity to the work. This method is objectionable on account of the time required for each coat to become dry before the succeeding one can be applied, and the mortar is liable to crack and become detached; and the inflammable character of the lath is another objection to this method.

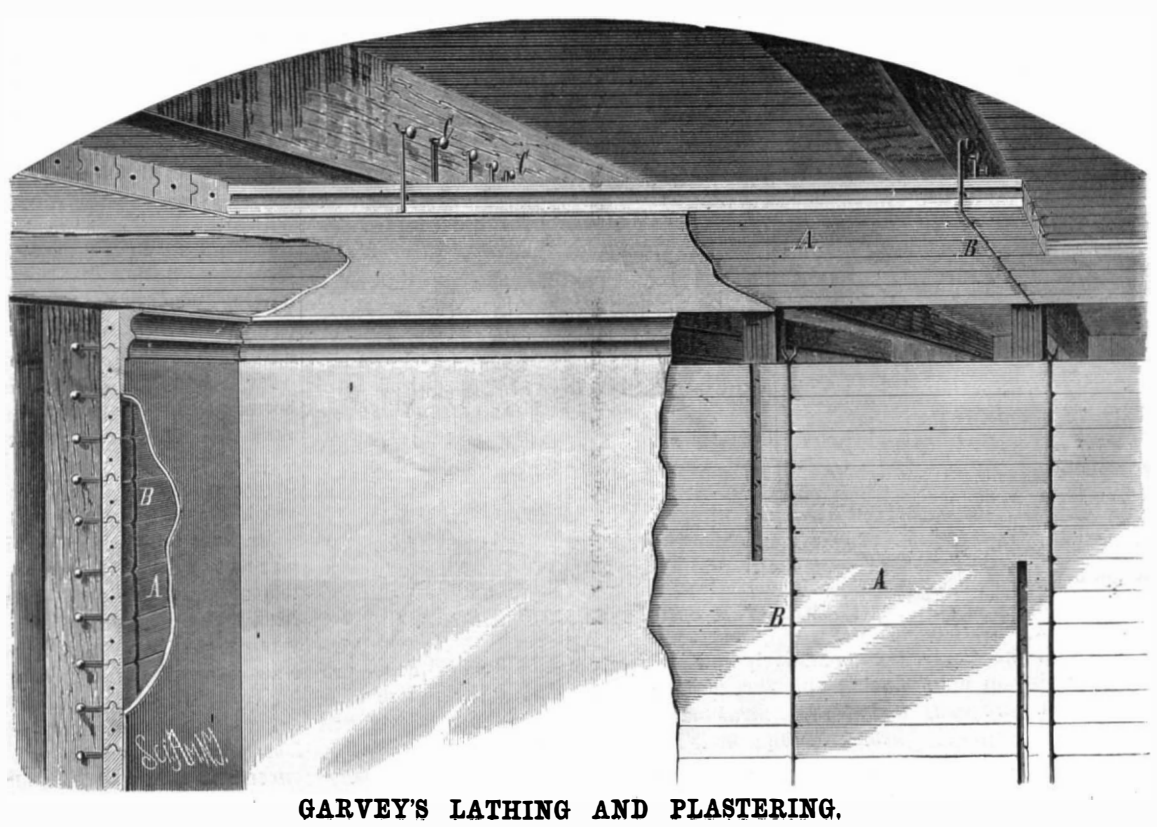
Our engraving shows a novel lath recently patented by Mr. Walter J. Garvey, of 407 Chestnut street, St. Louis, Mo. This lath consists of a bar of plaster of Paris cast in a mould around a stiffening and strengthening wire. The edges are tongued and grooved so that the entire series of laths may be locked together. These laths are made in lengths of 12, 16, 32, or 48 inches, as may be required. In width they may vary between 1½ and 2 inches.

Referring to the engraving, the laths, A, are secured in place by wires, B, looped over nails driven into the sides of the joists or studs. The contiguous ends of the laths are separated a short distance, and the intervening space is filled with plaster, making a smooth joint and at the same time fastening the laths by enveloping the wire core which is allowed to project beyond the end of the lath. As soon as the laths have been thus applied and fastened the white plaster coat or finish may be at once put on, when the work is complete.

This style of wall and ceiling may be made much quicker than by the ordinary methods, thereby saving three fourths of the time required to finish the walls of a house, and when done it is harder and more durable than ordinary lath and plaster walls and ceilings, besides being entirely fireproof.

The inventor informs us that this wall will not crack, as its peculiar construction admits of considerable change in the frame of a building without affecting the walls.

The lath may be manufactured where it is used, or it may be readily shipped to any point where needed.



GARVEY'S LATHING AND PLASTERING.

ENGINEERING INVENTIONS.

Messrs. Gustav Ripp and John Mueller, of Jersey City, N. J., have patented a new and improved automatic apparatus which will shut off the motive element from the engine in case the belts or machinery break or become disordered.

Mr. John H. Gable, of Shamokin, Pa., has patented an improved pipe cleaner for cleaning deposits of sediment from the inner surfaces of the column or pump pipes of mine shafts and slopes, and for cleaning out other pipes. The invention consists of a pipe cleaner formed of a cylinder or frame provided with cutters to loosen the sediment, wheels to crush and pulverize the sediment, and a brush to sweep the inner surface of the pipe.

Mr. Orlo H. Drinkwater, of Cedar Point, Kan., has invented a car coupling which consists mainly of a draw bar having a hook or shoulder and a link or clasp, which is pivoted and adapted to receive and lock with the shoulder or hook of a draw bar attached to the opposite car. The links or hinged clasps are held engaged with the respective draw bars by means of a spring or other suitable devices, and may be opened to allow uncoupling by means of rods, levers, or other means. The hinged loop or clasp is held open by a spring catch until the latter is acted on automatically, thus causing it to release the clasp.

IMPROVED MILL PICK.

The annexed engraving represents an improved mill pick patented by Mr. Edgar F. Lemoine, of Emmerton, Va. The novel feature of this pick is the employment of a thin blade tempered throughout its entire length, and capable of being entirely used up without forging or retempering. The invention consists in a pair of serrated clamping jaws, which receive the thin picking blades, the latter being provided on their inner ends with two or three ratchet teeth for engaging the serrations of the clamping jaws. The outer jaw is perforated with a screw threaded hole for receiving the threaded portion of the handle; the inner jaw has a plain hole through it fitting the plain portion of the handle. By turning the handle, by means of a lever or wrench, the jaws are brought firmly down upon the picking blades, which are as efficient as if they were an integral part of the jaws, having the advantage of being adjustable as they become worn.

LEMOINE'S MILL PICK.

The inventor proposes, in some instances, to put ratchet teeth only on one side of the blade, when two blades may be placed in each jaw.

The jaws may be conveniently used to hold the blades while grinding. This improved pick seems to possess many advantages over the ordinary form, it is easily kept in order, and is much cheaper, if the expense and trouble of sharpening and retempering are considered.

Railways and Population.

A table constructed by Prof. Stürmer, of Bromberg, shows the length of railway in several of the chief countries of the world and its proportion to the population. In Europe, on the average, there are 4·9 kilometers of railway to every 10,000 inhabitants. Greece has the least proportion to the population, having only 0·08 kilometer to every 10,000 of the population. Next comes Turkey, with 1·6; Portugal, 2·3, Roumania, 2·4; Russia, 2·8; Italy, 2·9; and so upward in the scale, France having 6·3; Germany, 7·1; Great Britain, 8·1; and Sweden heading the list with 10·8, though its total mileage is not a fifth of that of Great Britain. In Asia it appears that only 0·16 kilometer is averaged to every 10,000 inhabitants; and in Africa the proportion is only 0·17. In the United States the proportion is heavy—32·9 to every 10,000 of the people; while the whole of America has the average of 17·2, and in Australia the proportion is already 10·6. The thinly-peopled countries, the *Pall Mall Gazette* remarks, necessarily come to the front in this instance; but the table is of some interest as showing the effect of a large or small length of line in effecting

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comparisons of this nature, and also in indicating the comparative density of population to that of the facilities for its conveyance by rail.

THE CRINOIDS OF CRAWFORDSVILLE.

BY H. C. HOVEY.

The rocks of Indiana are generally hidden by heavy drift and lacustral deposits. Their nature and contents are ascertained by the exposure of strata along the line of streams, and more recently by quarries, mines, and other artificial excavations. Of the latter there were few in those early days when Prof. E. O. Hovey—for whom, in behalf of science as well as from filial regard, a place is claimed among the pioneer geologists of the West—began to explore the resources of that region. The extensive cabinet of Wabash College is a memorial of his diligence; but those who admire its specimens can hardly realize the weary rambles on foot and hazardous voyages by raft or canoe by means of which many of them were secured.

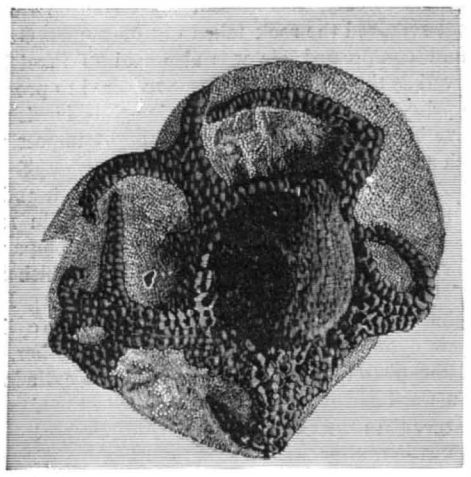
Here and there, along Sugar Creek, as it cuts its way through the woodlands and wheat fields of Montgomery county, my father discovered, as early as 1836, banks made up of rings and stems mingled with shells and geodes. Public attention was first called to these singular deposits in Owen's preliminary geological report (1838), on account of their economic value as material for the manufacture of lime. He merely says: "Four miles below Crawfordsville, at the mouth of Aufield's Creek, a stratum, some four to eight feet thick, of encrinital limestone is exposed." The next notice taken of the locality is in Lawrence's manual of the "Geological Formations of the Western States" (Boston, 1843), in which he speaks of it as exceedingly rich in encrinites. "Here," he says, "the finest specimens in the country are obtained, both on account of their size and beauty." I doubt if either of these gentlemen did more than make a flying visit to those crinoid banks, or saw anything better than the rings and stems referred to above.

Organic remains, such as those now described, both interested and puzzled scientific men long before their true nature was discovered. Three hundred years ago curiosity-hunters in Europe found pebbles impressed with star-shaped figures, and called them "trochites." At first, they were regarded with mysterious awe; and it was doubted whether they were crystals, petrefactions, or elfin charms. Certain flower-like impressions were afterward found on the rocks, which were called "encrinites," or stone lilies. The long stems and feathery corona of these mimic blossoms deceived even the great botanist, Linnæus, who did not detect their animal nature. In A. D. 1755, a "marine palm" was found near the island of Martinique, which was described as such in the tenth edition of "Systema Naturæ," under the name of the *Pentacrinus asterias*. This is now regarded as the typical crinoid.

Cuvier saw the truth that had escaped others, namely, that the Pentacrinus, instead of being a plant, was an animal, "a star fish with a stem;" and that the encrinite was its fossil representative, of which the trochites were only fragments. At a still later day the name "crinoidea" was given, by J. S. Miller, to include the entire order. In common parlance at the West the term encrinites has been given to the fragmentary stems, while that of crinoid has been reserved for the flower-like head growing at the upper end of the stem. For reasons that will appear more fully in the course of this article, we know that, where the former are most abundant the latter are rare, and indeed they are now sought in an entirely different stratum.

In the summer of 1842, a New York collector advertised for encrinites, offering to pay $5 a bushel for them on delivery. What a chance for a boy nine years old to earn pocket money! I forwarded a bushel of the stems at once, and told him he could have more at the same rate; but he sent word that the market was supplied! While filling this order I picked up a pebble wholly unlike anything previously found in the region, and prudently retained it for my juvenile cabinet. It was covered with warty protuberances, and hence was identified by the rustics as a "petrified toad," by the same process of guesswork that led them to describe the stems as petrified snakes, and the rings as Indian beads. But my specimen was really a weather-beaten *Actinocrinus*, and was probably the first true crinoid ever found in the Crawfordsville banks, whence thousands have since gone to adorn public and private cabinets in this country and in Europe. The locality where it was obtained is now called Corey's Bluff, and is about six miles above the spot mentioned by Owen. Other crinoid banks were also explored—at Remley's Ford, Island Ford, Indian Ford, and on Walnut Fork, Black Creek, and other tributaries of Sugar Creek. By diligent search, additional crinoids were found, and of greatly diversified peculiarities. They are referable to what is now known as the Keokuk group, forming part of the broad belt of sub-carboniferous rocks that sweeps entirely through the State from the Ohio River to Lake Michigan. To the early geologists, however, who cautiously felt their way along the path of science, it was simply known as "Formation No. 3," and its fossils likewise were for the most part merely numbered, except in cases where well ascertained distinctions warranted an attempt at classification by names. My father published several articles bringing the crinoid banks of Indiana to the notice of the scientific world; but he left the task of describing new genera and species to those whom he regarded as more experienced palæontologists.

As recently as 1848, the only books in existence devoted exclusively to the subject of crinoids were the monographs of Miller and Austin, treating wholly of those that had been found in Europe. Numerous papers on the subject had appeared, however, some of them dating back to the last century; but these were scattered through various scientific works with which Indiana libraries were at that time scantily supplied. New contributions to crinoidal literature have been made since then in profusion, especially in connection with the elegant volumes embodying the results of geological surveys in many of the Western States, until now it is



GONIASTEROIDOCRINUS TUBEROSUS—(Natural Size.)

said that three hundred and eighty naturalists have written on crinoids, and that their productions would fill a library by themselves!

Agassiz, in his "Methods of Study," skillfully and at considerable length, traces the homology of the echinodermata; showing that the star fish, sea urchin, serpent star, sea cucumber, and sea lily (crinoid) are but modifications of one persistent creative idea.

Haeckel exalts the Echinodermata from being, as in the Cuvierian system, a mere class of the Radiata—the lowest sub-kingdom—to an honorable rank as one of the seven chief tribes into which he divides the animal kingdom, and only the third below the Vertebrata. He also arranges the crinoidea in three families, namely, those having arms and stems (brachiata); those that are nut-like (blastoidea); those that resemble little sacs or pouches (cystidea). The Indiana crinoids are mostly brachiata, but the other two families are represented.

The anatomy of the crinoid presents certain remarkable features, to be described as follows:

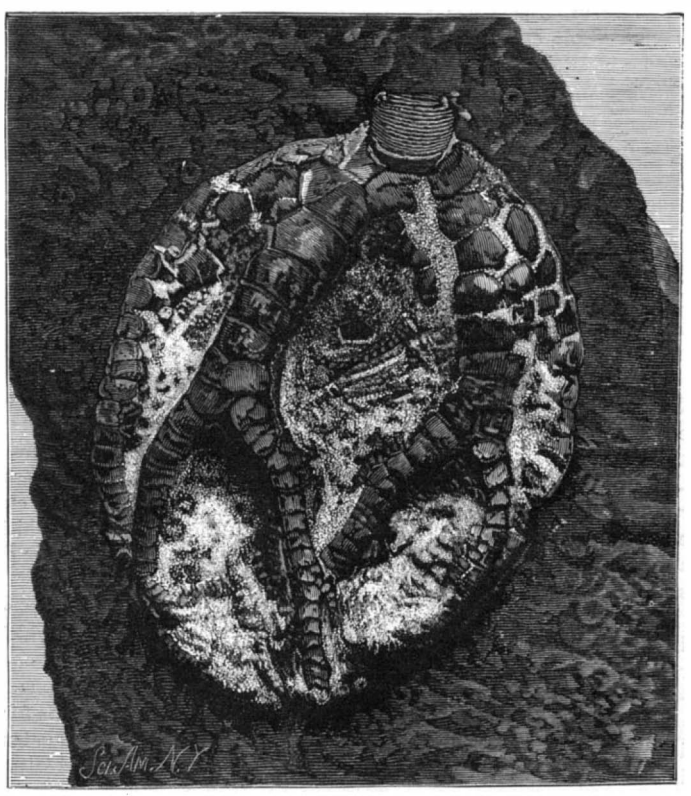


Fig. 2.—ONYCHOCRINUS EXCULPTUS—(Natural Size.)

1. *The Root.*—The comatula, and other free crinoids, have mere tufts of cirri, whereby to grasp sea weeds or any other support, or else to anchor themselves on muddy bottoms. They can free themselves at pleasure and either swim or float away elsewhere. But the fixed crinoids have stout, jointed, branching roots, some of which look like the stumps of diminutive oaks. These may grasp branches of coral, and the stems of other crinoids, or they may spread wide ramifications on the mud of the sea floor. Other roots are formed by a simple enlargement of the lowest ossicle of the stem, cementing it by concentric layers to a ledge of rock, whence the plant-like animal rises amid the waters. There are specimens in the Harvard Museum, in which this is reversed; the roots clinging to lignite, showing that these crinoids, which are from the Tertiary, originally hung down from floating blocks of wood.

2. *The Stem.*—This is a series of flat, calcareous rings, uniting to form a tubular column that rests on the root. The shape often varies, even in a single stem, making the identification of fragments difficult. The cyclindrical form prevails, but many are oval or pentagonal. The canal generally, but not always, conforms to the exterior. The rings are in some specimens extremely thin, while in others they are a quarter of an inch thick. They break with a crystalline fracture. The softer parts, not being capable of petrifaction, have disappeared; but it is supposed that in the living animal the joints were held together by fibers running lengthwise of the stem, and also by an integument. The canal was filled with gelatinous substance. The articulations of the disks usually radiate in fine lines from the canal outward. but in the curiously twisted stem of the *Platycrinus hemisphericus* a ridge coinciding with the long axis of the oval joint takes the place of these lines. This beautiful species has also two spiral rows of tendrils along a portion of its stalk, each joint furnishing a pair. In other varieties the tendrils protrude singly or in pairs, or in whorls of threes, or even fives. I have seen fifty successive rings without a tendril, and then one will shoot out of great relative size, spanning five or six rings at its base. Some stems are smooth, faintly marked cylinders; others are grooved, fluted, bead-like, moniliform, or decorated with spines and knobs. Usually they are broken up into pieces from one to five inches in length. But they often are much longer, and one was measured at Island Ford that was six feet long as it lay on the ledge. They vary in diameter from one thirty-second of an inch to an inch or more. Tablets of encrinital limestone are to be seen where they lie in coils and knots, cemented to the stone, with here and there a head in bass-relief.

3. *The Head.*—Every stem is fairly entitled to a head, but they are seldom found together. This is due partly to the existence of a peculiar split joint, called by Miller a "syzygy," not bound by muscles or fibers, hence easily snapped by a jerk, to free an entangled arm, that is afterward reproduced at leisure. Prof. Verrill states that living crinoids have to be taken with great care, and at once immersed in alcohol, or else they will literally fly all to pieces. This work of destruction is also aided by the natural decay of the membrane covering and holding together the whole body in life; whereupon the hundreds of calcareous plates fall apart. Hence good heads do not abound where the stems are best; but in beds of shale that was once mud, by which the animal was smothered and held while the stems, dismembered, sank down to a lower stratum. This is shown by a section of Corey's Bluff. On a floor of limestone rests a bed of blue shale, twenty-five feet thick, and almost completely made up of encrinite stems. Above this is a layer of gray sandstone, two feet thick, supporting a bed of softer shale than the first. Here the heads abound, being preserved as described. This is about five feet thick. Successive strata of sandstone, comparatively barren of fossils, rise for twenty-five feet, or to the soil. Thus deep and heavy excavations must be made in order to get at the fossiliferous horizon.

Inspection of a well cleaned calyx, or head, shows it to be built up of several series of plates. The lowest are the *basals*, being from two to six calcareous buttons resting on the terminal disk of the stem. Then come one or more circles of *radials* and *interradials*, uniting to form a visceral cup. The uppermost row is suitably beveled to receive the *brachials*, or arm plates. The primary branches are liable to repeated subdivision, until in some species there are from 80 to 100 rays, and the total number of plates exceeds 1,000, besides their fringe of graceful cilia. When the arms are expanded, or entirely removed, the close-fitting ventral plates are seen. The stomach is supported, as it seems from the researches of Meek and Worthen, by a convoluted cylinder, resembling the finest lace. The proboscis, or chimney, is really an excretory tube, rising from the ventral plates, in some cases, till it protrudes beyond the arms.

Austin, Murchison, and others regarded crinoids as predatory creatures, crushing and devouring shell-fish. But observation of living species proves this to be an error. The animal sucks in through channels in its arms, tiny streams holding food in suspension or solution. These are poured into the stomach, sifted perhaps by the net-like apparatus described above; then when all assimilable matter is extracted the exhausted liquid is spurted through the proboscis to such a distance as to prevent its immediate return. The currents thus made drew in young parasitic shells, which they also fed by animalcula. The most common of these in former ages were the *platyceras*, scores of which I have examined without finding any evidence that they either devoured or were devoured by the host that carried them; yet the shell sometimes grew to such a size as to be a troublesome if not a fatal guest. (See Fig. 1.)

The entire number of crinoids secured by us, including purchases, was about 2,000; varying in size from the *Onychocrinus exculptus* (Fig. 2) down to the merest buds and sprays. The best were cleaned for the cabinet; many were disposed of by exchange; the remainder are stored in boxes. It is estimated that more that 5,000 crinoids in all have

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been found in the vicinity of Crawfordsville by various collectors, among whom should be mentioned Mr. C. Dyer, Mr. F. H. Bradley, and the Coreys. Corey's Bluff is now the property of Prof. D. A. Bassett, whose improved methods, both of quarrying and of cleaning, have gained admirable results. The removal of the incrusted shale is effected by brushes, graded awls, and needles, and requires a degree of skill. Some specimens are so tender as to crumble under the most careful handling; and others are so hardened by silex as to be refractory. But patient manipulation is usually well recompensed.

A complete list, so far as known, of the fossils of the Keokuk group at Crawfordsville, was prepared by my father in the last year of his life, and after due revision was published in the State Geological Report of Indiana for 1875 (pp. 376–381), together with valuable observations by Prof. John Collett. From this catalogue it appears that twenty-seven genera and fifty-eight species of crinoids from that locality have been described by Hall, Meek, Worthen, and others, while several new species yet remain inedited.

Crinoids were the first of their class to appear in Paleozoic time. They became more scarce during the Mesozoic and Tertiary ages, until now they have mainly yielded the seas to star-fish, sea-urchins, and other modern echinoderms. It may be that their luxuriant growth in the period before the coal formation was due to water saturated with carbonate of lime and resting under pressure of a heavy atmosphere. That they then grew in shallow water is evident from the relation of the crinoid banks to the coal beds rich in remains of terrestrial vegetation. Only six genera of stalked crinoids are now known to inhabit the whole ocean, and these are found at depths ranging from 2,000 to 15,000 feet! Though eagerly sought for more than a century only twenty specimens were found, until the number was recently increased by deep sea dredging, whose results have been given to the world by Sir Wyville Thomson, in the "Voyage of the Challenger" and "The Depths of the Sea."

It is said that in Agassiz's expedition last summer 300 specimens were taken. Possibly somewhere amid "the abyssal province," including 140,000 square miles, the explored portions of which are to be reckoned only by the square yard, regions may yet be found where these beautiful sea-lilies are as abundant as they were when Indiana lay at the bottom of the sea, and instead of fields of wheat and corn had only crops of coral and crinoids.

NEW INVENTIONS.

An improved attachment for carriages, which furnishes a convenient support for carriages, has been patented by Emma J. Osborne, of Easley, S. C. The invention consists in a slide in the floor of the carriage, at the rear thereof, which slide can be drawn out to carry the baggage, and can be pushed back so as to be out of the way when not in use.

Mr. Martin J. Sunderlin, of Watkins, N. Y., has patented an improved apparatus for cleaning horses. The present invention is an improvement upon apparatus for which letters patent have been allowed to the same inventor, which apparatus consists, essentially, of a brush for cleaning horses, carriages, etc., a flexible pipe supplying water to the brush from an elevated or other source of water supply; and the object of the present improvement is to simplify and cheapen the construction.

An improved rubber bracelet has been patented by Mr. David Stone, of New York city. The object of this invention is to furnish rubber bracelets simple and inxpensive in construction and neat and ornamental in appearance. The invention consists in constructing rubber bracelets with extensions upon the opposite side edges of the band to represent buckles; also, in forming slots in the said extensions, and also in the combination, with the slotted extensions, of the cross bar placed upon the inner side of the band, with its ends projecting through the slots and resting upon the side extensions.

Mr. Abraham Van Winkle, of Newark, N. J., has patented a novel frame for anodes, the object being to prevent the falling apart of the particles or pieces of the anode after it has become disintegrated by the action of the electric current while hanging in the solution without substantially interfering with the exposure of the surfaces of the anode to the solution. The invention consists in combining a frame of wood or other suitable material, with the edges of an anode of cast or rolled metal.

Mr. Daniel Dunscomb, of New York city, has patented an improved cover designed especially for dredging boxes or for boxes intended to hold powders of any kind. It consists in a cover, preferably metallic, having a central aperture, and of a perforated metallic cap having a downward projecting notched elastic rim. This cap is removably fitted into the aperture of the cover.

Mr. Nathaniel Pyles, of 43 Canal street, Chicago, Ill., has patented an improved carpet and floor dust receiver. The object of this invention is to provide a dust pan or receiver that may be pushed along in front of the person sweeping by the broom as the carpet is being swept in the usual way, to receive all of the dust and dirt raised or swept up by the broom and carry it along until the entire floor has been swept.

An improved plow has been patented by Messrs Peter S. Swartz and Alexander Arnot, of Lexington, Mich. The object of this invention is to provide a double-ended plow so arranged that its movement can be easily reversed at the end of the furrow. The invention consists of a double-ended plow having the beam head, to which the beam and the handles are attached, pivoted to a plate on the upper edge of the land side in such a manner that the motion of the plow can be reversed by simply turning the handle and beam around the pivot, the body of the plow not being changed in its position.

AMERICAN INDUSTRIES.—No. 45.

THE MANUFACTURE OF AIR COMPRESSORS, STEAM ENGINES, AND PUMPS.—THE NORWALK IRON WORKS COMPANY.

A great deal of the success of some of the most difficult of modern engineering work has been due to the improved methods of applying compressed air to transmit the power required. By no other means at present known can the power obtained from steam or water be more conveniently stored and transmitted for use at long distances, so as to be readily applicable for all purposes. It was the expansive elasticity of air, condensed by the power furnished by a mountain stream, that worked the distant boring machines and removed the rock taken out of the St. Gothard tunnel; and compressed air was also said to furnish the lungs as well as the heart of the force required to prosecute this enterprise, as without the ventilation thus furnished it would have been not only tedious but almost impossible to make such an extensive excavation.

Probably one of the most economical, compact, and serviceable of the air compressors introduced within recent years is that made by the Norwalk Iron Works Company, at South Norwalk, Conn., whose establishment furnishes the subject of the first page illustrations of this paper. It is a steam engine and air compressor combined, the steam cylinder and two air cylinders being in line with each other, each stroke of the piston rod condensing air in the cylinders in both its outward and inward motions. One of the air cylinders is larger than the other, and here the air receives its first compression, after which it is forced into the smaller cylinder to receive the heavier compression. The heat developed by compression in this way is not so great as when the whole work is done in one cylinder, the air having time to cool in the intermediate pipes between the cylinders and while in contact with a very large cooling surface in passing under the water jackets of the two cylinders. The cylinders are strongly fastened to a long, heavy frame, which is bolted to a solid foundation, and two heavy fly-wheels give evenness and steadiness to the motion, a governor regulating the speed. By this arrangement of a compound compressor the power developed in the steam cylinder is so evenly applied in the reciprocating parts that the most economical speed of piston can be obtained. The air valves are placed in the cylinder heads, and the water for cooling the air while being compressed circulates around the cylinders in a jacket.

In the manufacture of steam pumps the Norwalk Iron Works have for many years held a leading position, and were in a measure the pioneers in the introduction of many of the most important modern improvements. They obtained the control of the "Earle" patents, and made many important improvements simplifying the mechanism, and increasing the efficiency and durability of the pump. To secure the latter point they obtained a patent for a changeable cylinder lining, in which the valve seats are of gun metal, fitted to gauges, so they can be quickly removed when worn out and new ones put in their places. This work can be quickly done without disturbing the pipe connections, and without material stoppage of any of the operations for which the steady working of the pump may be important. The composition lining is an important feature where a pump is to be used for corrosive liquids, since it resists corrosion much better than iron, and, the parts being interchangeable, it is but a short job at any time to make the pump practically "as good as new," and at small cost. At the time the company introduced these improvements they constructed new patterns throughout, giving their latest style the distinguishing title of "the Norwalk steam pump." These pumps are used for every variety of work, for boiler feeding, for fire purposes, for steamboats and factories, for oils, acids, sugar, liquor, chemicals, etc. Every pump is tested before it leaves the establishment. The department devoted to this work is shown in our illustration to the right at the top of the page.

The hoisting engine, shown in the engraving, represents one of the latest products of the Norwalk Iron Works Company in this department. It is simple in its parts, built with exceptional strength, and economical in its consumption of fuel in proportion to the power developed. The company also make horizontal stationary engines, several hundred of their manufacture being in use in different parts of the country. They have now running in their own establishment one of 75 horse power, which they built ten years ago, and which has been running ever since. It is almost noiseless in its operation, and the consumption of coal for the power required in the machine-shop and foundry, with that furnished for some other manufacturing operations on the premises, as well as steam for heating in the winter time, does not exceed an average of a ton and a quarter per day.

The general view at the center of the page gives a good idea of the extent of the establishment of the Norwalk Iron Works Company. The main building is 300 feet long by 100 wide, connected with which is an engine and boiler house, and at a distance of a foot is the foundry, 150 by 70 feet. They do business direct with their customers, from their place in South Norwalk, Conn., a siding from the New York and New Haven Railroad running direct to the works.

Going to a Fire.

One of the most exciting sights a stranger can witness in the lower part of New York is the fire department responding to an alarm of fire in the daytime. A representative of the *Fireman's Journal* describes a scene familiar to all our citizens, but one that many of our readers have probably never witnessed. We chanced to be in Broadway a day or two since, says the writer, when the street was crowded with vehicles of all kinds, and the sidewalks with a regular procession of pedestrians. Suddenly the gong of an approaching steamer sounded with its sharp, sudden, and continuous jingle; there was a rush of teams to clear the center of the street, and a rush of policemen to aid the drivers in getting their vehicles against the curb; then came a fireman running for dear life, shouting "clear the road," and right behind him came the steamer, the horses on the gallop, and a cloud of smoke issuing from the smoke stack; a moment, and she was gone. Then came a hook and ladder truck, with sounding gong, horses on the jump, and the members of the company clinging to their precarious perches on top. Next came the Salvage Corps, gong sounding, horses running, and the men urging them as if their lives depended on their speed. It was an exciting event, lasting but a moment, but quickening to the pulse of the laziest on-looker. Thousands of persons had stopped to catch a glimpse of the passing firemen, and for over a mile Broadway was jammed with vehicles and pedestrians, all of whom had turned out to make room for the firemen, on whose speed might depend the property and lives of some of our citizens. To a stranger the sight must have been a thrilling one, and impressed him with the efficiency of our fire department. We know that to our soldiers the heavy rumble of the apparatus seemed like the movement of artillery to the front and to presage an impending battle. And so it was a battle—a fight between the trained firemen and an enemy as old as the earth or the heavens, and one that has scourged mankind since time was.

Improved Telephone Call.

The *Boston Advertiser* describes an improved telephone call signal, which is about to be introduced in that city It is not of application where a subscriber has a private wire, but is for use in the smaller cities where several subscribers are on the same wire, and, when one is called, all hear the bell, and each must have his separate call. It is a device by which only the person desired may be called and so, without any particular style of call, as at present, he knows whenever he hears the bell that it is for him The apparatus is something like this: At the central office is a clock which regulates a clock in the office of each subscriber on the circuit, so that they all run in exactly the same time. This is done by setting the subscribers' clocks, so that whatever variation they have will make them faster than the central clock, and by a current of electricity they are made correct once in every minute. Upon the faces of these clocks and the central one is a dial around the second hand, marked off into as many divisions as there are subscribers on the wire. Whenever the second hand is in the division marked "1," the subscriber who has that number may be called and no other one will hear the bell. The same is true of No. 2 and so on around the circle. Suppose there are eight subscribers on the wire, each would have seven and a half seconds every minute in which he could be called—deducting a brief interval of silence at the beginning, which is given in order that the calls may not be mixed. As two seconds is ample time for calling a person, it will be seen that there is a good margin allowed. The apparatus is simple. A wire extends from each clock to the central clock, and at each clock is an electric call bell. A single cell in the battery is used, which gives enough electricity to call one bell, but not two. The possibility of the invention turns upon the fact that electricity will take the shortest path possible. When the bells are silent the electric current is passing along a direct line of wire, but when the bells sound the current is passing through several hundred feet of wire coiled at the bell, which closes the circuit when the fingers press the key in the central office. This change in the circuit is made by a simple arrangement in the clock, by which a lever is thrown in one position or another, turning the current into the coil or sending it straight on. If there were enough electricity on, the bells would all ring, but only enough is generated to ring one bell, and that bell is the one which, for the time being, is affected by the electricity in its coil. Since only one coil is affected at one time, only one bell will ring, and when a subscriber hears it he is sure it is for him. Mr. George H. Bliss is the patentee, and the patent is owned by the Signal Telephone Corporation.

A Queer Water Power.

In the neighborhood of Argostuli, in the Ionian Islands, a water power is utilized in a peculiar manner. At four points on the coast, the sea, at its ordinary level, enters a very narrow creek, or broken rocky channel, and after running somewhat rapidly through this channel and among broken fragments of rock, for a short distance, it gradually becomes sucked into the earth and disappears. By conducting the water through an artificial canal for a few yards, and so regulating its course and forcing all the water that enters to pass in a single stream beneath an undershot wheel, power enough is obtained in two cases to drive a mill. Mills have, in fact, been placed there by an enterprising Englishman, and are constantly at work. The stream, after being utilized, is allowed to take its natural channel, and is lost among the rocks.

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PORCELAIN CHIMNEY-PIECE.

Our engraving shows a chimney-piece, standing about twelve feet high, constructed entirely of hard and soft porcelain by the Rörstrand Company, Limited, Sweden. Its general color is lavender and celadon, picked out with gold, but there are other colors blending with these and making a harmonious whole of great delicacy and richness. The fireplace is surrounded with a beautiful border of flowers and leaves in white porcelain picked out with gold. The columns on either side are divided into plain panels of lavender and gold, separated by richly ornamented medallions. Above the columns is a frieze with scroll work of singularly beautiful design in celadon, lavender, and fine tracery in gold, while above that again is the white porcelain shelf, resembling in its purity and polish the richest marble. Above this, in the center of a long horizontal panel ornamented with an elegant scroll pattern in relief, is a charmingly modeled figure of Cupid, in the round, a most beautifully executed porcelain. Just over the Cupid, in a niche prepared for it, is an Etruscan vase standing some three feet high. The design and coloring of this vase may be said to be the *motif* for the rest of the chimney-piece, which is, so to speak, built up around this central figure. On sither side of the vase are columns, banded into diamonds below, and ornamented above with medallions containing the insignia of the arts and sciences. The whole space between the niche and columns is filled with scroll work, highly elaborated, yet of the most chaste design. The upper part of this superb work is in harmony with the richness of its lower portion. While the ornamentation is equally elaborate, it is lighter in color and treatment, and gives an effect of finish which is altogether satisfactory. Whether in this piece we consider the adaptability of the material to the use proposed, or the character of the ornamentation allowable in an object of this kind, or simply the effect of the whole as we see it, there can be but one opinion of its merit: its purity and harmony of design are admirable.

PORCELAIN CHIMNEY-PIECE.

History and Antiquities of Arizona.

The early history of Arizona has still to be written, but it is in most respects identical with that of Southern California, New Mexico, and Northern Mexico. That the original inhabitants belonged to the same civilization as that under which Mexico rose to so comparatively high a grade long before Cortes landed on its shores, is usually conceded, but whether the bulk of the people removed southward toward the consolidated empire of the Aztecs before the conquest of Mexico by the Spaniards; whether they remained and were swept away by the Spanish invasion from the south; or whether the Apache from the north drove them out of the open lands into the recesses of the cañons, and finally extinguished all but the few pueblos still remaining, is not certainly proven.

Probably the truth lies between the three opinions, and all the causes may have contributed to the depopulation of the country and to the ruin of the extensive cities, dwellings, canals, etc., which strew the plains and line the sides of the cañons. To the student of history nothing in Arizona equals in interest these architectural remains. Now that the railway is finished, many of these are comparatively accessible—the famous Casa Grande being only a few miles from the station of that name, while numerous other ruins exist in the districts around Florence and Phœnix.

A few miles from Phœnix are the ruins of two or three towns and the remains of two stupendous canals, one of which is forty feet wide, and in former times drew its supply of water from the river near the mountains, twenty miles distant. In this neighborhood are also the ruins of a building occupying a parallelogram of twenty feet by one hundred and thirty, with walls still over ten feet high. At from twelve to fourteen miles of Phœnix, at La Tempe, are remains of what must have been a populous city, and also another system of canals and reservoirs. Ruins of a similar description to those of Casa Grande have been found in the Rio Verde valley, on Pueblo creek and at Aztec pass.

Casa Grande, discovered by Father Kino, three hundred years ago, is situated near the Gila, a few miles from Florence. The main building is about fifty-five feet square, and four stories in height, with traces of two more stories. Each story contains five rooms, two thirty-five by ten feet, the other three twenty-four by nine feet, and all of them nine feet in height. The openings which once served for doors are three feet and one half high, two and one half feet wide at the base, and two feet wide at top. The whole of the interior is neatly plastered, the plaster perfect as when first put on. This building is surrounded by a wall, which, when perfect, was perhaps fifteen feet high, and six feet thick at the base, and within this are several smaller apartments, besides a sort of watch tower at the southeast and southwest corners.

The towns of the Moqui and Zuni, the former in the north of Arizona, and the latter just over the border in New Mexico, are in so many respects similar to the ruins scattered on plain and cañon, that they evidently belong to the same civilization; but whether the Indians are the remains of a separate tribe, or the remnants of many tribes, is one of the problems of the history of America.

In the Gila valley, one hundred and twenty miles from Tucson, are the famous Piedras Pintadas. A heap of rocks, about fifty feet high, is covered with rude figures, geometric, comic, anatomical. Here are squares, circles, crosses, triangles, snakes, toads, and vermin: men without heads and dogs without tails. The sketches show considerable similarity to the Aztec Calendar Stone in Mexico. It is a tradition with the Indians that those stones were put there in the time of Montezuma to record treaties between different tribes.

The "Indians" of Arizona evidently belong to several very different stocks. The wild Apache, formidable for his stealthiness and treachery more than from his numbers; the peaceful, not easily provoked, yet brave Pimo; the industrious Papago, and the town-dwelling, family-loving, orderly, clean, and self-contained Moqui, have little in common.

The distance which separates the rude Apache from the Moqui, with his old and respectable civilization, is as great as that between the rude tribes of Siberia and the cultivated Japanese.

The ruins in the cañons, on almost inaccessible terraces, are believed, by Major Powell, to be more recent than those of the plains. He believes the people took refuge there to escape the Spanish incursions.

THREE blow-flies with their descendants will devour the body of a dead horse as quickly as will a lion.—*Linnæus.*

Prehistoric Treasures of the Pacific Coast.

The Pacific coast, from Alaska to the Isthmus of Panama, is rich in vestiges of prehistoric races. Speaking of the lack of concerted efforts to gather up these important evidences of early man, and the need of a museum in San Francisco to illustrate the ethnology of the coast races, the *Bulletin*, of that city, says:

The field for exploration has been considered one of the most important on the globe. It has attracted the attention of scientists in Europe, and for years agents of scientific societies have been at work here. M. Pinart, a French scientist, has been working on this coast for years. He is an original investigator. He goes everywhere. Now he is digging into mounds in British Columbia, and next he may be on the islands in Tulare Lake exhuming skeletons. Then he goes off to Arizona, spends weeks or months among the Indians, learning their language, notes down every word he finds, formulates dictionaries, makes accurate drawings of the prehistoric ruins of Arizona, transcribes all the hieroglyphics which he finds, gathers up implements illustrating the Stone Age, looks into all the relics of Aztec civilization, examines hundreds of skulls and skeletons, and transmits the more valuable to Paris. Next he is in Sonoma doing the same kind of work. Probably, first and last, M. Pinart has sent over to Paris nearly a shipload of specimens. If these were now arranged in San Francisco, one of the most interesting museums of prehistoric records would be found here. But the specimens are not in San Francisco. No systematic effort has been made in that direction. M. Pinart makes his shipments, and prosecutes his scientific investigations from year to year.

Professor Bird has asked an appropriation by Congress for the prosecution of substantially the same work. He notes the fact that these relics are fast disappearing. That in a short time the records illustrating the ethnology of the Pacific side will disappear. The Smithsonian Institution, he thinks, ought to prosecute investigations in this field. Pierre Lorillard also proposes to bear half the expenses of a French expedition to Mexico for the same purpose. The relics discovered are all to be deposited in a French museum in Paris. M. Charney, a French savant, is to make the explorations. Nothing is gained for this country except the honor of having a man liberal enough to make a large appropriation for the purpose of adding something to the knowledge of the world touching prehistoric races. No doubt the interest which foreign countries are taking in the investigation has stimulated the managers of the Smithsonian Institution to ask for an appropriation from Congress for a like purpose.

The collection which has been deposited in this city illustrating prehistoric times, and especially the ethnology of races, amounts to very little. There is an odd specimen here and there—a skeleton, a skull, and a few stone implements, and that is about all. California is rich in their records; Arizona is richer still; Sonora, and all Mexico, are full of them. They are of sufficient value to be shipped to Europe. These shipments include some of the rarest specimens known in the world. New Mexico is also one of the most interesting fields for archæological investigations on this continent. The French scientists understand all this. They have now two expeditions in the field, or will have in a few days. M. Pinart's investigations are recorded in quarto pamphlet publications in Paris, and these in time form large volumes covering his archæological investigations. Probably M. Charney's investigations will be recorded in the same way. This country is not treasuring up her own historical monuments. They are treasured up by foreign scientific bodies. Is there no scientific body on this northwest coast which can prosecute investigations in this department?

It would take a few thousand dollars to lay the foundation of one of the most interesting museums in the world. One or two men in the field would be sufficient. No doubt arrangements could be made for duplicate specimens to be furnished by the investigators now in the field. But what is most remarkable is that San Francisco, which is almost in the center of the most interesting fields for archæological and ethnological investigations in the world, has no public collection, no museum illustrating these departments of science, although there are hundreds of odd specimens owned by individuals here and there. It was reserved for a French savant to give the most accurate explanation of the mounds which are found in this State, some of which are hardly more than an hour's ride from the city. He opened these mounds, exhumed the skeletons, examined all the articles deposited, and gave a more intelligent and satisfactory account of the origin and purpose of the mounds than had ever been given before.

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MECHANICAL INVENTIONS.

Mr. Martin A. Bidwell, of Sacramento, Ky., has patented an improvement in that class of shingle machines in which the shingles are split or rived from blocks or bolts and afterward smoothed and tapered, and has for its object to furnish machines so constructed that the shingles will be rived, smoothed, and tapered by a continuous operation.

An improved hand power attachment for sewing machines has been patented by Mr. Charles T. Christmas, of Riverton, Miss. The object of this invention is to furnish an attachment adapted for connection to the treadle of a sewing machine, whereby the machine may be driven by hand alone, or the attachment used to assist the operation of the machine by foot; and the invention consists in a certain novel combination of devices adapted for connection to the machine.

Mr. Frederic W. Link, of Belmont, O., has patented an improved valveless engine that when in operation shall move continuously in one direction, and shall transmit its motion by means of elliptic cog wheels.

Engineers' Club.

At a recent meeting of the Engineers' Club of Philadelphia, Mr. Arthur Sheafer read a paper on the Olean, Bradford and Warren and the Kendall and Eldred railroads, in the oil regions of McKean county, Pa. The O. B. & W. R. R. is 23 miles in length, from Bradford, Pa., to Olean, N. Y., reaching a height of 960 feet above Olean, or 2,398 feet above tide. Gauge, 3 feet; rails, 35 to 40 lb. per yard; maximum grade, 185 feet per mile, two miles being at a grade of 180 feet per mile; maximum curve, 30°, 350 feet in length on trestle 25 feet high. The road was commenced in November, 1877, and in sixty days trains were running between the termini.

The K. & E. R. R. is 18¾ miles long, from Bradford to Eldred, McKean county. Gauge, weight of rails, and maximum curves, same as O. B. & W.; maximum grade, 136 feet per mile; summit, 656 feet above Eldred, or 2,099 feet above tide. Crosses the Alleghany river on Howe truss bridge of two 90 foot spans. Its total cost, including equipment, was $150,000. In August, 1878, or ninety days after running preliminary lines, trains were running from Bradford to Eldred.

Mr. Neilson gave some notes on the Chicago and Tomah Railroad (narrow gauge), on which 20 lb. rails were used, even on 25° curves, and trains of seven cars, each of 13 gross tons weight, were run.

Mr. A. R. Roberts announced a recent trial run on the Bound Brook Railroad, by the single driver engine, of 89 3/10 miles, in 97 minutes, with four cars, and returning in 96 minutes with five cars. One run of 27 miles was made in 26¾ minutes. No heating of the machinery was observed.

Mr. J. J. DeKinder illustrated the French method of submarine diving, which is a great improvement on the old method, with heavy helmets, etc. The apparatus is composed of a horizontal cylinder, surmounted by another cylinder at right angles to it, with a rubber cap. The lower cylinder is connected with the air pump by a tube, and the upper by another tube with the diver's mouth. A spring clamp is worn on the nose, the tube held in the mouth, and the apparatus worn on the back like a knapsack. By the action of valves, the air is circulated as the diver breathes, and he is encumbered with no other apparatus. His loaded shoes do not interfere with ease of motion, and he can rise at will. As little diving is done in winter, the temperature of the water is not an objection to its general use.

The Desert of Sahara.

A correspondent of the Chicago *Times*, writing from the oasis of Tafilet, in the Sahara, April 7, says that so far from being a desolate plain of moving sand, as popularly believed, the Sahara is a cultivated country, fruitful as the Garden of Eden. Like our "great American desert," it has been greatly belied. El Sahr, as the Arabs pronounce it, is indeed a vast archipelago of oases, offering an animated group of towns and villages. A large belt of fruit trees surrounds each of these villages, and the palm, the fig, the date, apricots, pomegranates, and vines abound in the utmost profusion. Ascending the Atlas Mountains by a gradual slope to the region of high table-lands, we come to the land of the Mozabites, or Ben Mozab, and then comes a gradual descent for three hundred miles to the vast stretch of treeless country known as the great desert.

The rivers have an inclination of about one foot in four hundred. Many of the streams are dry, except after rains, when they deluge the country. Gun-shots are fired as soon as the torrents appear; all objects are removed, and soon, with a terrible noise, the flood rolls on. The Saharian city stands as if by magic on the banks of the waters which rise to the tufts of the palm trees; but a few days only elapse ere all disappears, leaving the district rich and fruitful. The inhabitants are not a migratory people, and, unlike the tent-dwellers of the northern slope, live in substantial houses with thatched roofs and ceilings of cane laid upon joists of alve wood. These houses generally consist of but one room, and have no furniture except mats on the floor and upon the walls for three or four feet high. Beds are sometimes found, but no one thinks of sleeping on them. The walls are whitewashed and inscribed with verses from the Koran. The inhabitants are made up of genuine Arabs and Berbers, or Kabyles, as the French call them. Jews are found in every oasis, and all very prosperous and influential, doing much of the trading and making up of the great caravans.

The Decay of Woodwork Out of Doors.

How to prevent the decay of woodwork exposed in open air to the changes of the weather, to alternations of wet and dry, heat and cold, is a problem that has taxed the ingenuity of man everywhere, and particularly in new countries, where wood is the only material available, or at least the only one easily employed in the erection of buildings. Most timbers, worms and insect enemies apart, will last a long time, if kept constantly dry or constantly wet in an equable atmosphere; but they will not long resist the effects of constant alternations from dry to wet and from wet to dry. More especially is this the case where the wood is placed in the ground, as in the case of the main sills of wooden houses, of post for railings, etc. Charring, painting, or tarring the surface of the wood is often adopted; but these remedies, even if always applicable, do not always produce successful results. They need to be continually renewed, and they certainly do not preserve the wood from the disease known as dry-rot.

The decay of wood embedded in the earth is also difficult to guard against; but, according to the *Farmer's Gazette* (Dublin), a simple precaution, costing neither money nor labor, will increase the durability of posts put in the ground by fifty per cent. This is simply by taking care that the wood is inverted—*i. e.*, placed in the opposite direction to that in which it grew. Experiments have proved that oak posts put in the ground in the same position as that in which they grew, top upwards, were rotten in twelve years, while their neighbors, cut from the same tree, and placed top downwards in the soil, showed no signs of decay for several years afterwards. The theory is that the capillary tubes in the tree are so adjusted as to oppose the rising of moisture when the wood is inverted.

Enjoined from Using his Own Name.

At St. Louis, recently, Judge Boyle rendered a decision in the case of Skinner *vs.* Oakes. It was a suit to restrain the defendant from using his own name in his own business. It seems that Oakes and Probasco were partners in the manufacture of an article of taffy called "Oakes' Candies," which became so popular that children cried for it and would have no other. The candy store was sold out to Skinner, with the right to make the taffy, and Oakes afterward opened a new shop, and manufactured Oakes' candies, the same as before. Skinner applied to the court to enjoin Oakes from calling his candies by that name, and also from using his own name in his business. Judge Boyle, after hearing the evidence, granted the injunction, and delivered a lengthy written opinion. After showing that the label put on his candy by Oakes is an infringement of the trade mark of Skinner, the judge goes further and says:

"I am also of the opinion that this restriction is not confined simply to the use of the words 'Oakes' candies,' as forming a single name, but to the use of the word Oakes at all in connection with the manufacture or sale of candies in this city. For to place this name in a position that it may be read at the same time or place that candies are displayed, is to impress upon the mind Oakes candies just as clearly and unmistakably as if the words 'Oakes' and 'candies' were printed or painted upon a sign as forming but one name. If one in search for what is known as Oakes' candies finds a store containing candies and upon its sign the name of Oakes, he would be simply an idiot not to connect the one with the other and believe he had found the object of his search."

Under this decision Oakes will be obliged either to change his name or quit the candy business. Like Esau, he sold his birthright for a mess of taffy, and must put somebody else's name on his packages. As the children cannot be made to believe that that which they call Oakes' candy by any other name will taste as sweet, the only thing left for Oakes is to shut up shop, or get himself newly baptized. His occupation, like Othello's, is gone, so far as his good name is concerned. If he should start a pickle factory and put his name on the jars of gherkins, the children would believe the cucumbers to be Oakes' candy colored green, and buy them as real taffy. Mr. Oscar Gray, the defendant's attorney, talks of filing a motion asking the judge to amend the decree by changing Oakes' name to Acorn, so that he can continue in the candy business without being considered a counterfeit of himself.

A New Street Sweeper.

A new street sweeping machine, devised by Mr. F. W. Schroder, of this city, promises to greatly reduce the cost of keeping streets clean. The dirt is swept by revolving brushes upon a traveling canvas, on which it is carried to a chute leading to a dump cart, into which it is discharged. When the cart is full the chute is raised by a lever, which also detaches the cart. The brushes make 240 revolutions a minute, and the canvas travels between 30 and 40 miles an hour. Two men are required for the machine, the driver and the man to attend to the chute. It is claimed that each machine will clean over a mile of street in an hour. The largest machines are 19 feet long, 6 feet wide, and 7 feet high; they weigh 5,400 pounds, and cost $650.

THE Assistant Treasurer of the United States in New York has notified Secretary Sherman that unless the silver dollars stop pouring into the vault from the Mint, that receptacle will soon overflow, and he will really be in distress to know what to do with them. He has over five hundred tons on hand just now, and nothing will persuade anybody to accept them in payment of dues when they can avoid it.

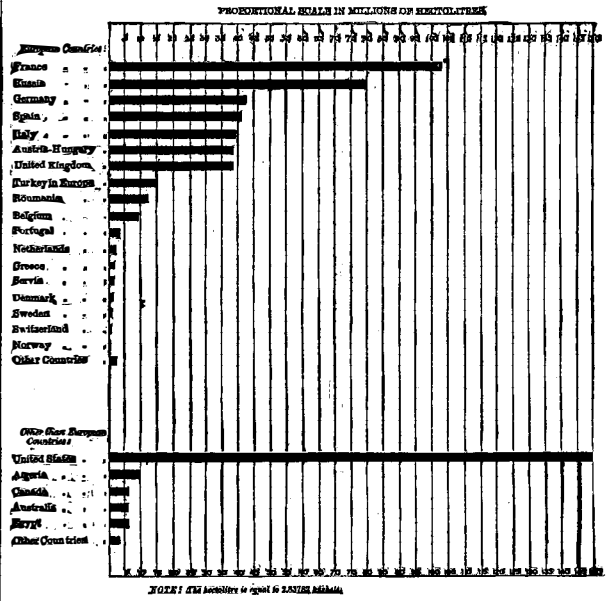
Persistent Life of Girdled Trees.

Usually a girdled tree soon dies; but it would appear from the following statements of Mr. W. H. Ragan, of Clayton, Ind., that such is not always the case:

"Hon. F. Beeler, General Superintendent of the Indiana State Board of Agriculture, living four miles southwest of Indianapolis, has a Scotch pine tree from which the bark has been removed for a space of almost a foot, when about three inches in diameter. At this point the wood is as dry and lifeless as a table leg, but above, the top is healthy, making regular and thrifty annual growths, bearing and perfecting seed, and to all visible appearance as healthy as though nothing unusual was the matter with the tree. This condition has existed for years, and the growth above the girdled point has increased to more than three times the size of the tree below. This tree was girdled by the sapsuckers. The other is a tree of the same variety on the farm of Allen Miles, two miles east of Belleville, in Hendricks County, Indiana, which was completely strangled by an iron ring, two and a half inches in diameter, being dropped over it some years ago. Below the ring for several inches the wood is dead and dry as though it had been in a dry kiln for years; above it is greatly enlarged, perhaps quadrupled in size, and still alive, though declining."

WHEAT PRODUCTION OF THE WORLD.

The Bureau of Statistics of the United States Treasury Department publishes the following diagram as showing the proportionate annual average production of wheat in the several wheat producing countries of the world. It is copied



from a semi-official French source, but with the explanation that the product of France for 1879 was 25 per cent *below* the annual average, that of Russia 10 per cent *below*, and that of the United Kingdom, or Great Britain, 50 per cent *below*, while the actual production of the United States was slightly *above* what is given as an average.

Extensive Filtering.

The Holyoke (Mass.) correspondent of the *Paper Trade Journal* says that a filtering experiment on a large scale is about to be tried by a company in that city, to obtain pure water for washing purposes in the manufacture of paper. Quite near the mills is a piece of land lying lower than the canal, and this the company proposes to fill with water to the extent of about three acres. Pipes will conduct the water from the canal bank into a bed of gravel some eight feet in thickness, through which it will pass, and it is expected that the filtering and the subsequent standing of the water in the reservoir will purify it sufficiently. The water will be about ten feet deep on an average, and will be pumped from a point about midway between the surface and the bottom. The experiment is a new one, and will be watched with interest.

Vennor's Prophecies.

Mr. Henry G. Vennor comes forward again with his direful prophecies of storms, heat, cold, etc, His letter is dated at Montreal, May 18, and in it he says: "I believe that June will be an intensely hot month, on the whole, but the end of the present month, and probably 'the first of June,' will be fall-like with frosts again. July will be a terrible month for storms, with terms of intense heat, but another fall like relapse, with frosts, will in all likelihood occur a few days before the 20th. I fear the storms of thunder and hail will be of unusual severity during July. I must claim the verification of my prediction relative to 'a cold wave with frosts, over a large portion of the United States between the 10th and 15th of May.' The relapse toward the close of the present month will be more severe than that just past."

IT is well known that butter, cream, milk, and flour are peculiarly liable to absorb effluvia, and should, therefore, never be kept in mouldy rooms, or placed where there are sour liquids, aromatic vegetables, such as onions, cabbage, and turnips, or smoked fish or bacon, or indeed any kind of food or thing of strong odor, lest they lose their flavor. But alas, add the *Sanitarian*, how much more essential is it that the utmost care be used in the prohibition of bedside food and drink in the nursery and the sick room, a practice fraught with constant danger to the sick, and of spreading disease to the well.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

The "Finger Annunciator," and all other electr. apparatus, by the Finger Annunciator Co., 73 Cornhill, Boston.

Lubricene, Gear Grease, Cylinder and Machinery Oils. R. J. Chard, 6 Burling Slip, New York.

Wanted—A Foreman of experience, capable of running a Jobbing Machine Shop employing forty men. Address, with reference, W C & Co., P.O Box 6, Chicago, Ill.

Improved Machinery for Waxing Paper for Sale, including an established trade. Price reasonable, profits good. For particulars, address Z. W., P. O. Box 773, New York city.

[From the Jackson (Miss.) *Clarion.*]

Mr. C. H. Manship, of Jackson, one of the best painters in that State, and a gentleman of great intelligence and worth, says, in reference to H. W Johns' Asbestos Liquid Paints: "I have tested them fully and am prepared to say that the paints, which are of all colors and shades, are not only the cheapest, but the best I have used in my experience as a painter for the past fifty years."

Skinner & Wood, Erie, Pa., Portable and Stationary Engines, are full of orders and withdraw their illustrated advertisement. Send for their new circulars.

Carbon Plates. 48 Railroad Ave., Jersey City, N. J.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 49 & 50 Astor House, N.Y.

Purves' Automatic Boiler Cleaner for removing impurities from the water in steam boilers, and keeping them cleaned and free from scale. Send for circular to Joseph T. Janes, No. 11 Franklin St., Chicago, Ill.

R. R. Hind, inventor of the new steam boiler described on page 358, current volume, may be addressed until July 16, 1880, in care of W. H. Crossman & Co., 118 Chambers St., New York.

Manufacturers of machines to cleanly remove hulls and germs from well soaked corn without injuring the rest, please address, with description and price, D. R. Garden. Room 22, Cooper's Union, New York city.

Asbestos Board on Chimneys prevents their heat from affecting the temperature of rooms through which they pass. Asbestos Pat. Fiber Co., lim., 194 Broadway, N. Y.

Air Compressors. Clayton Steam Pump Works, Brooklyn, N. Y.

Wilson's Business Directory, second edition, and Wilson's Co-partnership Directory for 1880-81, are now ready. Price, $3 each. All orders addressed to the Trow City Directory Company, No. 11 University Place, New York, promptly attended to.

$5 to $20. A County Right. A Clothes Line Fastener. Sample by mail, 20 cents. J. A. Worley, Cleveland, O.

Air Compressors, Blowing Engines, Steam Pumping Machinery, Hydraulic Presses. Philadelphia Hydraulic Works, Philadelphia, Pa.

Sweetland & Co., 126 Union St., New Haven, Conn., manufacture the Sweetland Combination Chuck.

Power, Foot, & Hand Presses for Metal Workers. Moderate prices. Peerless Punch & Shear Co., 52 Dey St., N.Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Corrugated Traction Tire for Portable Engines, etc. Sole manufacturers, H. Lloyd, Son & Co., Pittsburg, Pa.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros. 531 Jefferson St., Philadelphia, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Steel Figures, $1; Letters, $3 a set. York & S., Clev., O.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Sheet Metal Presses. Ferracute Co., Bridgeton, N. J.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 365.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $20. Attached to any instrument. T. Shaw, 915 Ridge Ave. Phila.

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Forsaith & Co., Manchester, N. H., & 207 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

For Alcott's Improved Turbine, see adv. p. 234.

Burgess' Non-conductor for Heated Surfaces; easily applied, efficient, and inexpensive. Applicable to plain or curved surfaces, pipes, elbows, and valves. See p. 284.

Eclipse Portable Engine. See illustrated adv., p. 349.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N J.

4 to 40 H. P. Steam Engines. See adv. p. 348.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Blake "Lion and Eagle" Imp'd Crusher. See p. 365.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 365. Totten & Co., Pittsburg.

Silent Injector, Blower, and Exhauster. See adv. p. 364.

Horizontal Steam Engines and Boilers of best construction. Atlantic Steam Engine Works, Brooklyn, N.Y.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Peck's Patent Drop Press. See adv., page 364.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Brass & Copper in sheets, wire & blanks. See ad. p. 365.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

For Superior Steam Heat. Appar., see adv., page 365.

We will purchase or manufacture on royalty, Stationers' Articles of real merit. A. C. Farley & Co., Phila., Pa.

Valve Refitting Machine. See adv., page 364.

Cut Gears for Models, etc. Models, working machinery, experimental work, manufacturing, etc., to order. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of last week.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 366.

The best Truss ever used. Send for descriptive circular to N. Y. Elastic Truss Co., 683 Broadway, New York.

Inventors' Institute, Cooper Union. A permanent exhibition of inventions. Prospectus on application. 733 Broadway. N. Y.

Improved Work Holder for Lathes, Gear Cutting, Attachments for Lathes, Tyson Vase Engine, Small Steam Motor. No boiler, no danger. Send for new catalogue, 1880. Jackson & Tyler, Baltimore.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 365.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds; strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

New Economizer Portable Engine. See illus. adv. p. 365.

Catechism of the Locomotive, 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Hand Fire Engines, Lift and Force Pumps, for fire and all other purposes. Address Rumsey & Co., Seneca Falls, NY., and 93 Liberty St., N. Y. city, U.S.A.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

NEW BOOKS AND PUBLICATIONS

HUBBARD'S RIGHT HAND RECORD AND NEWSPAPER DIRECTORY, 1880. New Haven: H. P. Hubbard. Price $1.50.

The favorable opinion of Hubbard's Right Hand Record, expressed by us last year, is equally justified by this year's issue. It gives a complete list of all the newspapers published in America, and all the leading newspapers of the world. The names are arranged in alphabetical order under the towns of each State (also alphabetically arranged), with population of town, circulation of paper, blank spaces for advertising records, etc. Business men cannot fail to find it right handy as well as useful.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) D. J. F. writes: I would like to get a book by which I could get the correct way of getting at the lead and lap and cushion of steam engines, and what cushion and what lead are required to engines of different sizes and speeds; likewise some information of compound engines and their handling: in fact a book of plain questions and answers which any man can see into. A. Consult "Roper's Land and Marine Engines," "Edwards' Catechism of the Marine Engine," "Forney's Catechism of the Locomotive."

(2) G. R. C. writes: Referring to "Notes and Queries," No. 15 (May 1), we do not understand what is meant by T=latent and sensible heat. A. T=sum of latent and sensible heat—sensible heat of steam at the pressure of the atmosphere is 212°, and the latent heat 65°, sum=277°. 2. With water at 50° and steam 690 lb, what percentage of fuel is saved by using water at 100°, also at 150°? A. You can have no water at 50°. With steam pressure at 60 lb. pressure, it will be about 307°.

(3) J. N. H. asks: Does electricity pass between two points more easily in air than in a vacuum? A. More easily in air than in a high vacuum, as it is possible to create a vacuum so perfect that a spark will not pass at all. The spark passes more easily through rarefied air than through air at the ordinary density.

(4) E. L. F.—A good common black ink is prepared as follows: Dissolve 15 parts extract of logwood in 900 parts of water, allow to deposit, heat to boiling, and add 4 parts crystallized sodium carbonate. Dissolve in 100 parts of water 1 part of yellow potassium chromate, and add this drop by drop, with constant stirring, to the logwood solution. After standing for a few hours the ink will have assumed a full bluish-black color.

(5) J. M. asks: 1. Do you know of any solution with which to moisten tissue paper in order that a press copy may be taken from writing which has already been once copied, or from writing too old to copy from ordinary water moisture, and which will not discolor the paper? A. Try a weak solution of tannic acid. 2. In looking over my back numbers of SCIENTIFIC AMERICAN I found a receipt in No. 11, Vol. 35, page 171, query 8, which I tried, but without success; it also colored the paper green. Or is there any ink from which two press copies may be taken with an interval of about a week or ten days between the copies? A. A strong aqueous solution of aniline blue, violet, or black (soluble nigrosine) will answer your requirements very well.

(6) H. O. asks: What are the exact proportions of sulphur, lampblack, and niter in gunpowder? A. English war powder—niter 75 parts, sulphur 10, charcoal 15. French war powder—niter 75 parts, sulphur 12½, charcoal 12½. Sporting powder—niter 76·9 parts, sulphur 9·6, charcoal 13·5. Blasting powder—niter 62, sulphur 20, charcoal 18.

(7) T. R. M. writes: I have a large wooden cask for holding maple sap. What could I paint it with on the inside, to prevent the sap from penetrating the wood and souring, that would not injure the sap? A. Have you tried melted resin colophony?

(8) E. K. writes: I have a good deal of copper plating to do. The solution I have, I succeeded so far of obtaining a nice bright copper color, but it will not keep. After I washed it off with warm water and exposed to the air for half an hour it turned into a rusty brown. My solution consists of *Schwefelsaueres Kupfer* dissolved in water with some sulphuric acid. How can I make the right kind of solution for such purpose? A. Use a saturated aqueous solution of copper sulphate (blue vitriol). Clean the work thoroughly by boiling in strong soda solution, pickling in dilute sulphuric acid, and scouring with clean sand, if necessary. If the work is iron use a strong battery at first.

(9) R. A. P. asks (1) for a certain and yet safe exterminator for roaches or croton bugs. A. Powdered borax does very well if properly used. Inject it, by means of a small bellows, into all the crevices and holes.

(10) F. C. R. asks: 1. Why are rotary engines not used for all the purposes of an engine? A. Because it is almost impossible to keep them tight under the conditions of constant use, and it is difficult to arrange them to work expansively to the desired extent. 2. Is there any method of reversing a rotary engine? If so, where can I find information regarding it? A. There is no difficulty in reversing them. You can find description in almost any history of the steam engine and in the back numbers of the SCIENTIFIC AMERICAN.

(11) F. G. N. writes: 1. I am building a light paddling canoe, according to the descriptions contained in the SCIENTIFIC AMERICAN SUPPLEMENT, Vol. ix., No. 219, page 3484, and do not understand how to make the watertight bulkheads. A friend told me that the sides in which the slats are made are curved by steam. Explain the building of the watertight bulkheads in your valuable paper, and if curved by steam, please tell me how it is done. A. Make the bulkheads of rubber cloth or cotton canvas painted, closely nailed around the edges. The sides are steamed in an ordinary steam box and bent to shape and fastened on a proper form and left to dry on the form.

(12) L. V. A. asks for a remedy for removing freckles and tan from the face. A. The following has been recommended: Sulpho-carbolate of zinc 2 parts, pure glycerine 25 parts, rose water 25 parts, alcohol 5 parts. Apply twice daily for a half hour.

(13) N. L. writes: I am building a small horizontal double cylinder steam engine, two and a half inch bore and four inch stroke, what is its power? A. At 260 revolutions per minute, 2½ horse power. 2. How large a fly wheel will it require? A. About 16 or 18 inches diameter. 3. What is the number of thread to the inch in machine taps standard from ⅛ inch to 4 inches? A.

Diameter in inches	¼	5/16	⅜	7/16	½	9/16	⅝	¾	⅞	1
Threads per inch	20	18	16	14	13	12	11	10	9	8
Diameter in inches	1⅛	1¼	1⅜	1½	1⅝	1¾	1⅞	2	2¼	2½
Threads per inch	7	7	6	6	5½	5	5	4½	4½	4
Diameter in inches	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾	5
Threads per inch	4	3½	3½	¾	3	3	2⅞	2¾	2⅝	2½
Diameter in inches	5¼	5½	5¾	6						
Threads per inch	2½	2⅜	2⅜	2¼						

4. Do you think the iron mercury flasks would be strong enough to run the above engine? Where can I buy them? A. Yes, you can generally obtain them from druggists.

(14) W. L. H. asks: How much lead of the valve should the valve of a 100 horse power engine have, and what is the rule for giving a valve the required amount of lead? A. Probably about three-sixteenths inch. There is no rule; it depends upon pressure of steam, size and form of opening, and the velocity of the engine.

(15) A. M. asks: Is steam applied successfully to plowing? A. It has been in England, but we believe not in this country.

(16) E. W. S. asks for directions for making paste such as is used for making paper matrices for newspaper stereotyping. Would like to have directions for making the back and face paste. A. Starch and fine glue, equal parts; soften the glue by digestion over night in cold water; then dissolve it in enough hot water to make a thin size; boil the starch in water to form a clear paste; add this to the glue and stir together; thin with hot water when necessary; warm before using.

(17) W. S. H. asks: 1. How long should work be left in the nickel bath for a good deposit, if everything be in good working order? The bath is composed of sulphate of nickel and ammonia. A. About twenty minutes is usually allowed, but with a weaker battery several hours may be allowed and better work will result. 2. What should cause the work to turn out black and rough? A. The battery used is much too strong; use a more moderate current. 3. Is there any work printed on nickel plating? I have the SCIENTIFIC AMERICAN from Vol. 32, and all the SUPPLEMENTS, but do not find much in them about it. A. You will find a good article on this subject on p. 209, Vol. 38, SCIENTIFIC AMERICAN.

(18) C. H. J. asks how much a rod of common round iron, one inch in diameter, fifteen to eighteen feet long, will support on a steady strain. A. If of good iron, 3,800 lb. safely.

(19) G. W. F. asks: For what purpose is ground or powdered mica used? A. It has been used in loading some kinds of paper, in the preparation of paints and bronze powders, in connection with nitroglycerine for certain explosives, as well as in toys. It makes an excellent fertilizer in soils deficient in alkalies.

(20) M. M. L. writes: I have a small steam yacht, 28 feet over all, 8 feet beam, propelled by a 4 fluke 28 inch diameter screw; the engine is an ordinary upright link motion. Everything works very nicely except the valve to the engine, which wants facing. How shall I face it in good shape? A. If you have not access to a good planing machine, you must face it by hand, with file and scraping tool.

(21) H. S. H. asks which has the most power, 2 cylinders 8x10, connected to one shaft with an 8 foot driver or fly wheel, or one cylinder 10x18, with an 8 foot fly wheel—both to run 125 revolutions per minute. A. 10x18 inch, making the same number of revolutions per minute.

(22) E. D. F. writes: I have very nearly completed a small upright steam engine, diameter of cylinder 3⅛ inches, stroke 6 inches, which I intend to run at 200 revolutions per minute. I have put on a balance wheel, 24 inches diameter, and will belt from a 12 inch pulley. How much power ought I to obtain from such an engine with 50 lb. of steam? A. Two horse power nearly.

(23) G. H. P. asks: What size boiler will it require for 1½ inch cylinder, and what should be the length of stroke? A. The stroke may be three inches to four inches; the boiler should have eight to ten feet heating surface.

(24) W. O. T. asks (1) the proper width and thickness for the packing ring of an engine, 1½ inch bore and 3 inch stroke. A. 3-16 to ¼ inch thick and ¾ inch wide. 2. Would the ring be better made of brass than cast iron? A. No. 3. Why are two rings used on large engines? A. To have one set break joints with the other, so as to prevent leakage and to give greater elasticity.

(25) S. B. M. asks: 1. Is the forked top on a lightning rod any better than a straight one, both being made of the same metal (copper)? A. A forked top is generally considered best. 2. I have a 30 inch wood saw, with a 150 lb. balance wheel, on end of saw mandrel; saw makes about 500 revolutions to one of the horse power. I cannot get power enough in sawing large wood. Some claim it would run better without balance wheel; but I think the driving pulley is not large enough. What is the trouble? A. Keep on your balance wheel, and use two horses if one has not sufficient power. 3. 3. Would a boiler, 10 inches diameter, 20 inches long, be sufficient to run a 1x2 engine about 45 revolutions per minute—boiler to set in a stove same as a teakettle? A. Yes. 4. Would copper, such as stove boilers are made of, be heavy enough for the boiler, and what pressure would it stand? A. Use copper three times as thick as that used in stove boilers.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated.

L. L. L.—1. Labradorite and hornblende. 2. Same as No. 1, but with more of the hornblende and also orthoclase. 4. Garnetiferous sandstone with hornblende. 3. Hornblende rock.—T.W.G.—Pyrrhotine containing a small quantity of arsenic and antimony. It cannot be called an ore. It is of very little economic value.—D. C. K.—It is a fine silicious stone, probably of infusorial origin. It might be useful for polishing purposes if obtainable in powder or blocks free from coarse impurities.—A.—It is not a meteorite, but a fragment of altered hornblendic rock, not valuable.—W. R. L.—It is galena—sulphide of lead, carrying a trace of silver.—G. I. L.—Metallic antimony.—E. G. T.—Mica schist of little value.—O. A. S.—Manganiferous clay iron stone.

COMMUNICATIONS RECEIVED.

On Gum Elastic. By A. T.
Chemical Apparatus. By J. E.
On Edison's Light. By D. F.
On Quartz Crystals. By W E. H.

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INDEX OF INVENTIONS

FOR WHICH

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May 11, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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Tobacco, smoking, Weisert Brothers ... 7,906

English Patents Issued to Americans.

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☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

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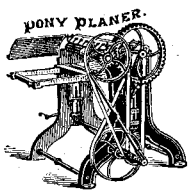

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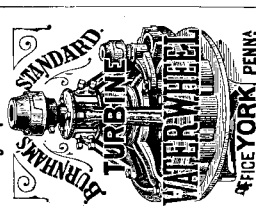

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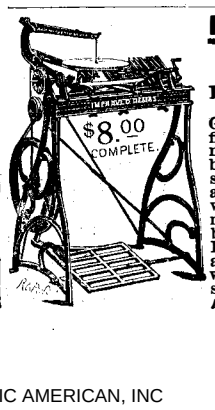

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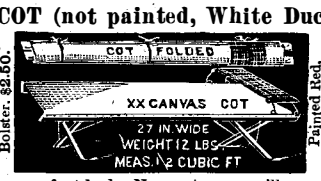
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MEAS. ⅛ CUBIC FT
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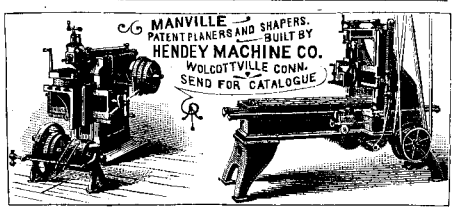

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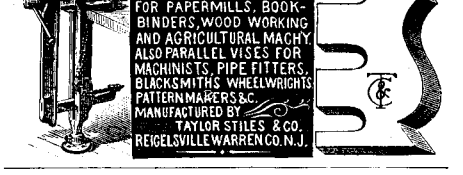
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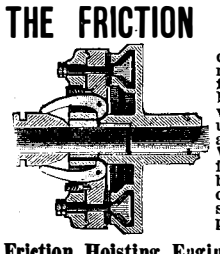

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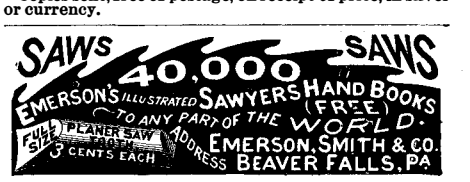

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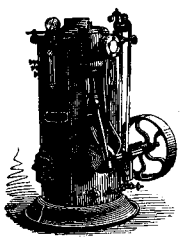

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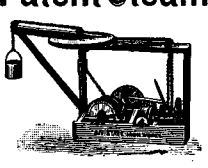

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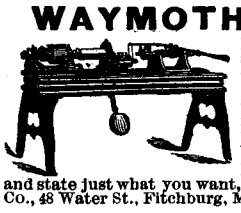

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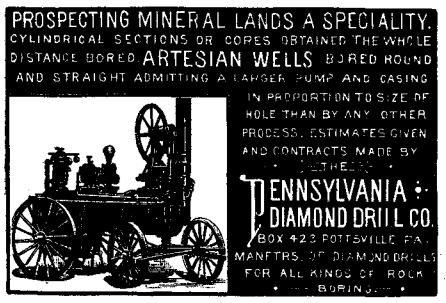
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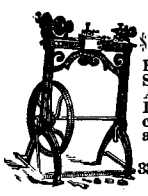

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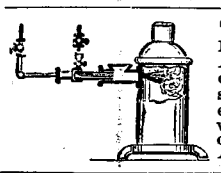

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FOR EVERY DUTY.

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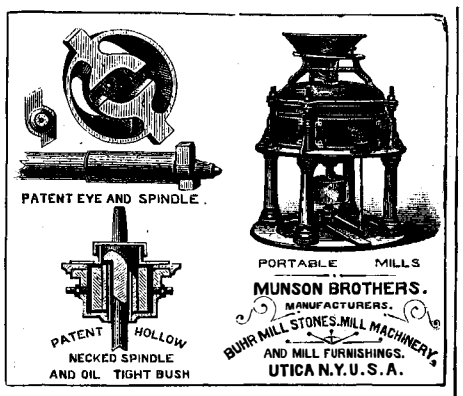

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Machinery of Every Description.
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TELEPHONE Works 1 mile. Price $3.50. Pat'd
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It is believed that were owners fully aware of the small difference in cost which now exists between iron and wood, the former, in many cases, would be adopted, thereby saving *insurance* and avoiding all risk of *interruption to business* in consequence of fire. Book of detailed information furnished to Architects, Engineers, and Builders, on application.

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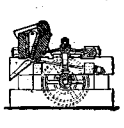
Patented November 18, 1879.



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THE WORTHINGTON PUMPING ENGINES FOR WATER WORKS—Compound, Condensing or Non-Condensing. Used in over 100 Water-Works Stations.

WORTHINGTON STEAM PUMPS of all sizes and for all purposes.

Prices below those of any other steam pump in the market.

WATER METERS. OIL METERS.

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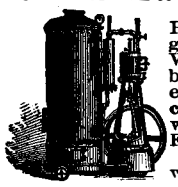
ESTABLISHED 1840,



Patent Spark-Arresting Engines, mounted and on skids. Vertical Engines with wro't boilers. Eureka Safety powers with Sectional boilers—**can't be exploded.** All with Automatic Cut-Offs. From **$150 to $2,000.** Send for Circular. State where you saw this.

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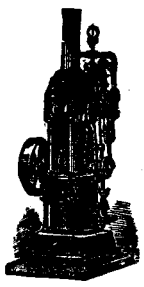

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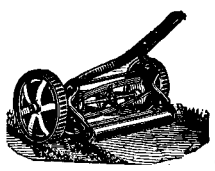

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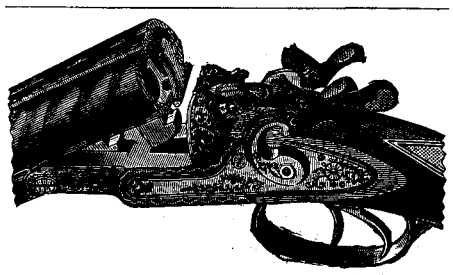

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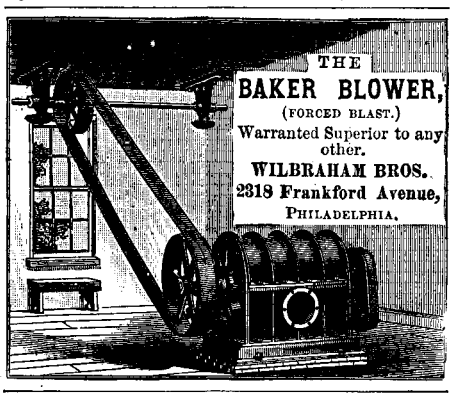

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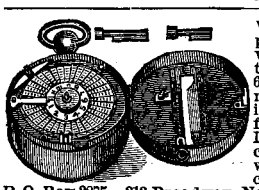

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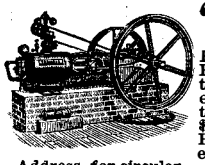

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